REPORT OF

GREEN AUDIT

Mar Thoma College for Women Perumbavoor

Perumbavoor
Ernakulam District,
Kerala, India

Based on International Standards
ISO 14001: 2015, ISO 50001: 2018,
ISO 46001: 2019, ISO 14046: 2014,
ISO 14067: 2018, ISO 45001:2018

TIES

MAR THOMA COLLEGE FOR WOMEN PERUMBAVOOR
Affiliated to Mahatma Gandhi University, Kottayam

REPORT OF GREEN AUDIT

Based on International Standards

ISO 14001: 2015, 50001: 2018, 46001: 2019, 14046: 2014, 14067: 2018, ISO 45001:2018

Auditee

Mar Thoma College for Women

Perumbavoor, Ernakulam District, Kerala PIN : 683542

Affiliated to Mahatma Gandhi University

Auditor

Tropical Institute of Ecological Sciences

ISO 9001:2015 Certified organization

Ecological Research Campus, K.K. Road, Velloor P.O., Kottayam, Kerala - 686501

Affiliated Research Centre of Mahatma Gandhi University, Kottayam

Tel: - 9497290339, 9633723305, 0481- 2957050

isogreenaudit@ties.org.in; www.ties.org.in

March, 2026

Disclaimer

This report is meticulously crafted by the Environment Management Committee of Mar Thoma College for Women, Perumbavoor, Kerala with invaluable guidance and support from the ISO Green Audit Consultancy division of the Tropical Institute of Ecological Sciences (TIES: www.ties.org.in), located in Kottayam, Kerala.

As an integral component of the Green Audit initiative conducted within the college premises, the data presented herein has been diligently collected by a team of certified internal auditors. College hostels and centenary block are not included in the study. Furthermore, the Report and Manual of Documented Information have undergone rigorous. Scrutiny by external auditors from TIES, ensuring alignment with ISO standards.

Published on 26th March 2026

Mar Thoma College for Women, Perumbavoor

TIES wish to acknowledge respective contributor's photographs and graphics are given in the pages 01,21.31, 33,45,54,67,68,71,79,81,91,115,151,153,167,225,227,241,243,257,249,255

Preface

We are pleased and excited to present the Green Audit Report of Mar Thoma College for Women, Perumbavoor, Kerala. This report represents the result of extensive research, careful analysis, and committed efforts to thoroughly assess the Environmental Management System (EMS) of our institution. As a college dedicated to educational excellence, Mar Thoma College for Women, Perumbavoor, understands the vital role of environmental stewardship and sustainability. In alignment with these values, we conducted a comprehensive review of our environmental practices, identifying strengths and areas for improvement in various aspects of our operations.

The report provides a detailed overview of our environmental performance, including an Energy Audit, Water Efficiency Management Audit, Waste Management Audit, Biodiversity Audit, Occupational Health & Safety and Carbon Footprint Data. Each section offers valuable insights into our resource use, conservation initiatives, and environmental impact, demonstrating our commitment to creating a greener and more sustainable campus.

The findings in this report not only highlight our dedication to environmental responsibility but also set the foundation for strategic initiatives to further enhance our sustainability efforts. By implementing the recommendations outlined here, we aim to continuously improve our environmental performance, reduce our ecological footprint, and inspire positive change both within our campus community and beyond.

We sincerely thank all those who contributed to this report, including management, Principal, IQAC, faculty, staff, students, and external stakeholders. Your collective efforts have been crucial in advancing our environmental objectives and reinforcing our commitment to sustainability. As we continue on this journey, we remain dedicated to the principles of sustainability, innovation, and excellence, working together toward a greener and more resilient future for everyone.

Environment Management System Committee
Mar Thoma College for Women, Perumbavoor, Ernakulam Dist.
26.03.2026

In every walk with nature,
one receives far more than he seeks

- John Muir -

Table of contents

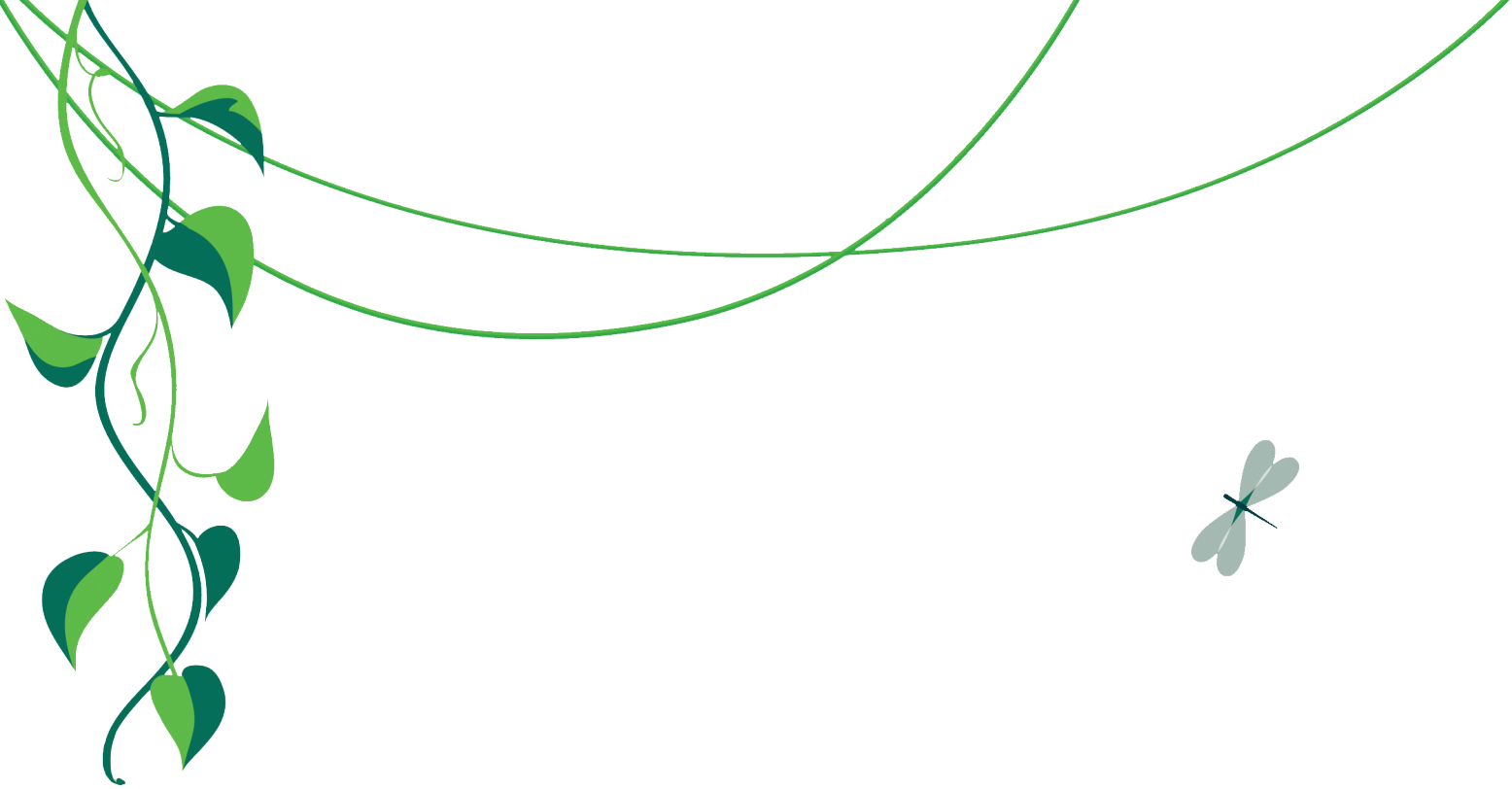
Chapter I

GREEN AUDIT AT ISO STANDARDS FOR COLLEGES & UNIVERSITIES

An Introduction

TIES

MAR THOMA COLLEGE FOR WOMEN PERUMBAVOOR
THE TRUTH SHALL MAKE YOU FREE



The Earth does not belong to us.
We belong to the Earth

- Marlee Matlin -

1

Green audit at ISO Standards

1.1. INTRODUCTION

Green audit in colleges, also known as an environmental audit or sustainability audit, is a systematic examination of an educational institution's operations, practices, and facilities to assess their environmental impact and identify opportunities for improvement in sustainability efforts.

During a green audit, various aspects of the college's operations are typically evaluated, including energy consumption, waste management, water usage, transportation, procurement practices, and overall environmental policies. The audit may involve gathering data, conducting interviews with key stakeholders, and assessing compliance with environmental regulations and standards.

The goal of a green audit in colleges is to promote environmental responsibility, reduce the institution's ecological footprint, and foster a culture of sustainability among students, faculty, and staff. By identifying areas for improvement and implementing targeted strategies, colleges can enhance their environmental performance and contribute to broader efforts toward sustainability and climate action.

1.2. HIGHER EDUCATION AND SUSTAINABLE DEVELOPMENT

The 2030 Agenda, powered by the UN Sustainable Development Goals (SDGs), goals encompass a broad view of development, spanning environmental, social, and economic sustainability.

The SDGs serve as a compass for nations, institutions, and civil society to navigate their journey towards lasting peace and prosperity for both people and the planet. In this monumental task, every individual and organization have a role to play. Among them, higher education institutions (HEIs) occupy a unique and pivotal position.

Firstly, HEIs have a primary mission to educate and train the future leaders, equipping them with the skills and knowledge necessary to contribute to sustainable societies.

Secondly, HEIs undertake a significant and innovative role in research, generating cutting-edge knowledge and technology that can drive societal progress.

Thirdly, HEIs directly benefit communities by sharing their knowledge and technology and forging alliances with other stakeholders in the Quadruple Helix, which includes governments, industry, and societal groups.

Moreover, the management and administration of HEIs offer an opportunity to lead by example, promoting ethical and sustainable governance, strategies, and operations.

This distinctive position empowers HEIs not only to participate in but to lead the charge toward sustainable economic, social, and environmental development. However, this potential comes hand in hand with a significant responsibility to do everything possible to advance sustainable development. While many HEIs already contribute to the SDGs in various ways and to varying degrees, these efforts are often scattered and lack a comprehensive institutional-level sustainability approach or strategy.

In this era of unprecedented global challenges, it's time for HEIs to unite their efforts, align their strategies, and take a leadership role in driving sustainable development forward. Together, they can be the change-makers, guiding us towards a brighter, more sustainable future for all.

[Adapted from "General guidelines for the implementation of sustainability in Higher Education Institutions", 2023. UNESCO & UN Academic Impact].

1.3. UN SD GOALS AND ISO STANDARDS

The UN-SD goals, an ambitious action plan to enhance peace and prosperity, eradicate poverty and protect the planet is recognized globally as essential for the future sustainability of our world. To be successful, the process requires consensus, collaboration and innovation. ISO has published more than 22000 International Standards and related documents that represent globally recognized guidelines and frameworks based on international collaboration. Built around consensus, they provide a solid base on which innovation can thrive and are essential tools to help governments, industry and consumers contribute to the achievement of every one of the SDGs.

ISO standards support the three pillars of sustainable development :

Economic - ISO standards promote economic sustainability by facilitating international trade, improving a country's national quality infrastructure and supporting sustainable business practices. They cover everything from efficient farming methods to anti-bribery management systems.
Social - ISO Standards promote social sustainability by helping countries and communities to improve the health and well-being of their citizens. They cover all aspects of social welfare, from healthcare systems and related products to social inclusion and accessibility.

Environmental - ISO International Standards promote environmental sustainability by helping businesses and countries manage their environmental impact. They cover such aspects as implementing an environmental management system, measuring and reducing greenhouse gas emissions and energy consumption, and encouraging responsible consumption.

1.4. GREEN AUDIT AT ISO STANDARDS- WHY?

Green Audits are not merely an obligation for NAAC accreditation; they are in alignment with the broader canvas of Sustainable Development Goals. This dynamic form of environmental scrutiny reveals compliance gaps and pinpoints areas for bolstering management systems, all while proposing viable corrective actions.
Green audit helps to reduce negative impacts on environment and enhancing conservation in college and university campuses. Its main objectives are:

- A systematic examination to assess an institution's environmental responsibility
- Aims to identify environmental compliance, gaps or lapses in implementation of conservation activities
- Checking whether they meet stated institutional objectives and complied with including environmental management laws and ISO standards
- Suggesting corrective measures for improvement
  It is highly significant for every academic institutions in the present scenario:
- Mandatory as per the NAAC advisory
- Essential for complying with SD Goals

- It can help to improve the quality of academic and research processes, by complying environmental quality standards which are at par with international standards.
  Help to identify areas where improvement could be possible.
- It can exhibit your university/college as an institution of international standards.
- It will help to bring more accreditations and awards easily.
- ISO certification will help to save money by streamlining your processes and making them more efficient.

1.5. GREEN AUDIT CERTIFICATION BODY

The present audit report is evaluated and external audit is conducted by Tropical Institute of Ecological Sciences (TIES- www.ties.org.in), following relevant ISO standards.

TIES is a trailblazing, professionally managed environmental research organization with over 10 years of experience in conducting comprehensive green audits in academic and research institutions, in accordance with relevant ISO protocols. Accredited with the prestigious ISO 9001:2015 certification, TIES has built an illustrious track record, having audited 30 colleges across arts, science, and professional streams, as well as two leading universities in South India, bringing extensive expertise to every audit it undertakes.

TIES have developed a unique Green Audit protocol based on relevant ISO standards. The Green audit certification for academic and research institutions by TIES is based on the following international standards:
1.5. Steps of green audit as per ISO standards.

No.	Phase	Major activities
1	Pre Audit Period	Questionnaire survey Pre audit visit to assess the facilities/infrastructure available Identify the key persons/system personals- organize for the audit
2	Audit activities at the site	Collection and collation of information (review of records) Conducting audit, Monitoring and verification
3	Post audit period	Draft report, Final report

Table 1.1. Stages of Green Audit

1.6. GREEN AUDIT AS PER ISO STANDARDS AT MAR THOMA COLLEGE FOR WOMEN, PERUMPBAVOOR

1.6.1. Process of green audit as per ISO standards

The Green audit programme as per ISO standards and developed by TIES is a ccustomized package for universities and colleges in India, considering prevailing specific academic and social environment. It is relatively simple and easy to implement and practice.
A PLAN-DO-CHECK-ACT System is implemented.

Fig.1.1. PDCA cycle of Green Audit

1.6.2. Mar Thoma College for Women, Perumbavoor

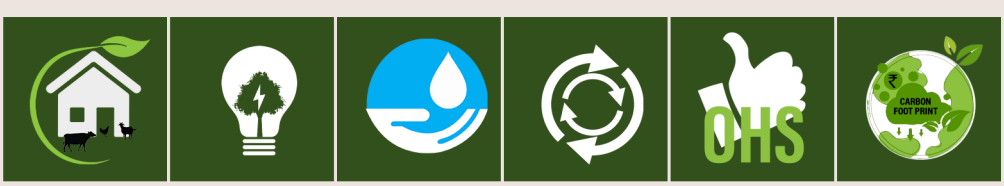
The IQAC coordinator and the Principal of the college requested Tropical Institute of Ecological Sciences (TIES) to conduct a green audit at the college on 18.02.2025. TIES initiated the formal proceedings of the audit by requesting the prerequisite data for green audit from the college, on 20.02.2025. The college has submitted required information on 22.02.2025. Subsequently, the MoU for green audit was signed between the Principal of the college and Secretary, TIES on 13.03.2025 for a period of three months for the completion of the audit process and valid for three years. Experts from TIES ISO Green Audit Consultancy division had given a full day training for internal auditors on 13.03.2025. All participants who passed the evaluation process were given with certificate as Internal auditor.

Internal auditors aggregated to various committees like Environment Management System Committee (EMS), Energy Management System Committee (EnMS), Water Efficiency Management System (WEMS), Waste Management System(WMS), Biodiversity Management Committee (BMC) and Occupational Health and Safety Management Committee (OHSM). The internal audit process have been implemented and carbon foot print of the college was estimated by EMS of the college. They collected data on various audit components and documented, analyzed and prepared the report.

The final external audit by assessee from TIES was conducted on 19.12.2025
The first surveillance audit is scheduled for March 2029.

GREEN AUDIT
Based on ISO Standards

Environment Management System

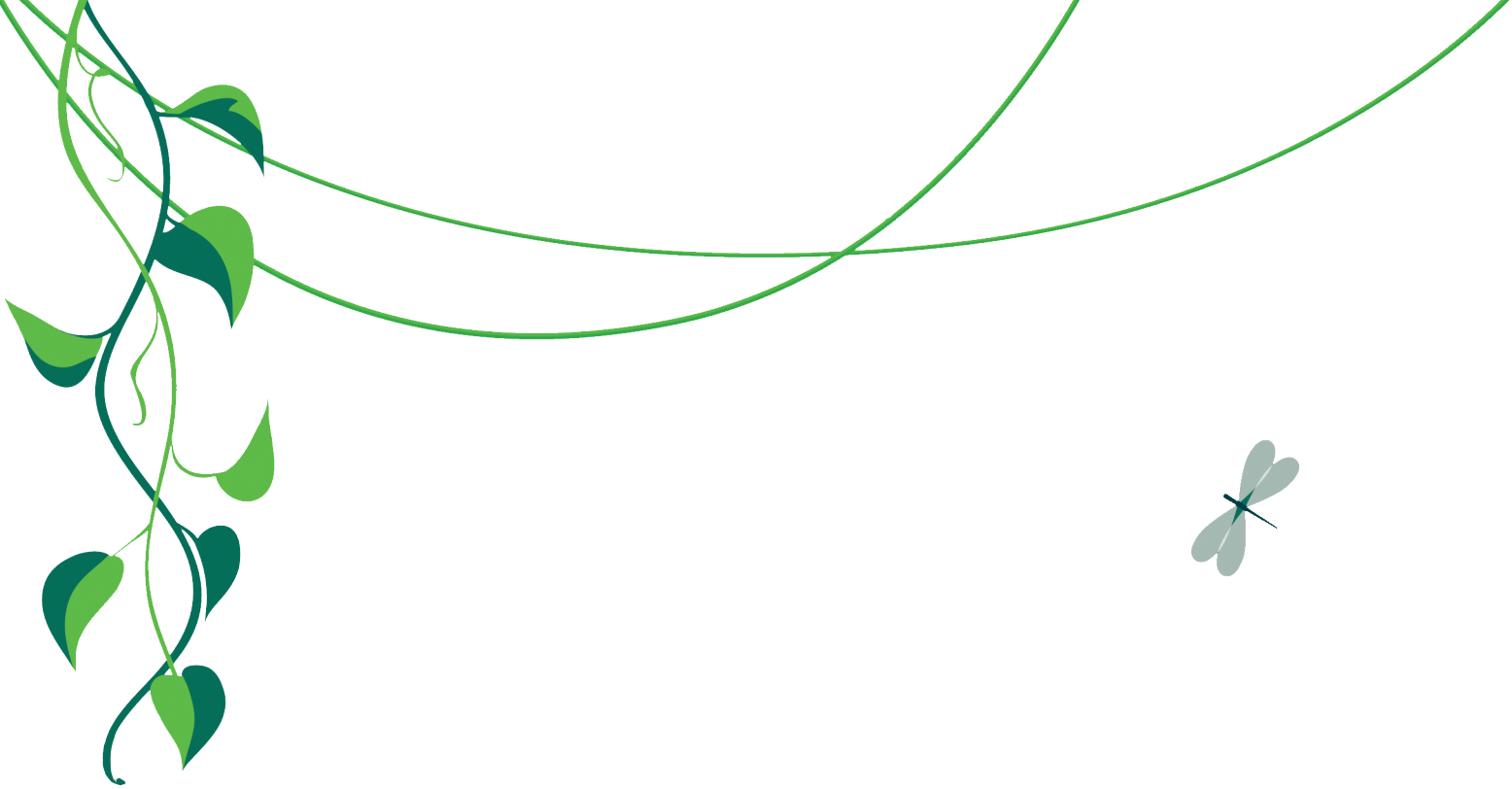


Biodiversity Management System | Energy Management System | Water Efficiency Management System | Waste Management System | Occupational Health & Safety | Carbon Foot print

TIES 2025

Chapter II

COLLEGE PROFILE
MAR THOMA COLLEGE FOR WOMEN



Sustainable development begins
with Education

- UNESCO -

2

College Profile
Mar Thoma College for Women

2.1 PROFILE OF THE COLLEGE

Mar Thoma College for Women, established in 1982, embodies the vision of the late Thomas Mar Athanasius Suffragan Metropolitan of the Mar Thoma Syrian Church. Centrally located in Perumbavoor, this esteemed institution was established to fulfill the educational aspirations of young women from rural and suburban backgrounds. With a rich legacy of excellence in education rooted in distinguished institutions such as St. Thomas High School (1922) and Asram High School (1931), the Mar Thoma Church has played a pivotal role in advancing women's empowerment through high-quality higher education. Spanning a scenic 10-acre campus, the college is dedicated to sustainable practices that prioritise environmental conservation. It implements a range of initiatives focused on waste management, water conservation, and energy efficiency, thereby cultivating a green and eco-conscious learning environment for its students. Mar Thoma College for Women has garnered significant recognition for its commitment to educational excellence, as evidenced by its accreditation history. Initially accredited at the B level (72.5%) in 2003, the college was re-accredited at the same level by the National Assessment and Accreditation Council (NAAC) in 2012. During its third cycle of NAAC accreditation in 2017, the college elevated its standing to a B+ level (CGPA: 2.63). In its fourth cycle in 2023, the college achieved an A+ grade (CGPA: 3.45), further attesting to its dedication to providing exceptional quality education for women. With a dedicated faculty of nearly 100 members and an enrolled student body of approximately 800, the institution emphasizes inclusivity and the holistic development of women from diverse socio-economic backgrounds. The college offers various skill-based training programs, certified vocational courses, PSC coaching, and foreign language classes, ensuring that students acquire the expertise necessary to make meaningful contributions to society. Mar Thoma College for Women remains steadfast in its mission to provide quality education while fostering sustainability, social responsibility, and academic excellence, thereby positioning itself as a leading institution in Kerala's higher education landscape.

2.2 VISION OF THE COLLEGE

To enlighten and empower women in rural and suburban society and enable them to act as agents of social transformation and acquire knowledge of self and surroundings and to make the world a better place.

2.3 MISSION

- To stimulate the most conducive ambience for the promotion of quality in teaching and learning.

- To empower women students hailing from rural background to face the challenges of life with dignity, honour and self-respect and to inculcate self-esteem in them.
- To become a centre of excellence providing value-based education aimed at the integrated development of individuals into responsible citizens with social commitment.
- To groom the personality of students making them self-sufficient to reach out to the less privileged, the downtrodden and the abandoned in the community
- To mould a team of students with the required knowledge, skills and attitude with global competency, capable of working towards the transformation of the society.
- To create awareness to live in harmony with the natural environment, to preserve it and to act as agents of peace, goodwill, natural integration and solidarity to make the world a better place.
- To enable students to communicate effectively and to empower them to face the issues and challenges with poise and confidence.

2.4 MOTTO

The college's motto, "The Truth Shall Make You Free," highlights the belief that true freedom is achieved through the pursuit of knowledge and wisdom. Rooted in the teachings of Jesus Christ and echoed in various philosophical traditions, it emphasizes enlightenment, righteousness, and liberation from ignorance. This guiding principle reflects the institution's commitment to academic excellence, moral integrity, and holistic education.

2.5 GOALS AND OBJECTIVES

Education is a living process of intellectual growth, character building and personality development. This total development materializes only when a balance is established between body and spirit, intellect and emotion, mind and attitude and when there is a total integration of the diverse faculties operating in human beings. It is in this context that the College sets its goals and objectives.

I. Academic Goals

a) To work towards the growth of the institution into a centre of excellence.

b) To encourage students and teachers in the pursuit of knowledge a n d in setting high standards of academic achievement.

c) To develop free and fearless thinking leading to intellectual and moral maturity.

d) To promote a spirit of adventure and investigation leading to true wisdom and understanding which makes all study a discovery a n d a joy.

e) To keep-up with the times and to take steps to impart a need-based education

II. Value Orientation and Character Building

a) To produce 'total persons' with holistic perspective, scientific outlook and artistic sensibility.

b) To foster morally firm and spiritually upright young women with respect for traditional Indian values and appreciation of the higher values of life.

c) To mould individuals who seek and serve the truth, by emphasizing disciplined living, industry, humility, openness, sincerity and honesty in all realms of thought and action.

d) To instill in students democratic ideals, principles of secularism, freedom, mutual respect and tolerance and an awareness of human rights so that they grow into responsible citizens and emissaries of national integration

III. Social Goals

a) To mould a team of students with fact, understanding, commitment alertness to relevant socio-political issues and awareness of civic responsibilities, thereby instilling compassion, selfless devotion, service mindedness and the capacity to rejoice in the hopes and aspirations of the underprivileged.

b) To empower the women students by helping them to become strong, self-reliant, socially motivated, responsible and dedicated women and better citizens of

tomorrow, so as to equip them to meet the challenges in life positively.

c) To foster in the students etiquette leading to the right interpersonal relationship in an atmosphere of co-operation, peace and goodwill, thereby making them effective agents of socio-economic changes.

d) To make the students aware of the pressing global issues and the moral responsibility to handover to the coming generation an eco-friendly life style and an earth free from pollution, filth, bigotry and corruption.

e) To enable the students to come out from the stagnant pool of orthodoxy into the clear stream of reason, perfection, tolerance and dynamism.

2.6 CORE VALUES

ARISE

- **A** ADEPT
- **R** RIGHTEOUSNESS
- **I** INTEGRITY
- **S** SERVICE ORIENTED
- **E** EMPOWERMENT

2.7 GOVERNING COUNCIL

The Mar Thoma Evangelistic Association owns the College. The Most Rev. Dr. Theodosius Mar Thoma Metropolitan is the present Patron of the College. Rt. Rev. Dr. Issac Mar Philoxenos Metropolitan is currently the Manager and the Chairman of the College's Governing Council.

Sl.No.	Name	Designation
1	Rt. Rev. Dr. Issac Mar Philoxenos Episcopa	College Manager
2	Rev. Aby K. Joshua	General Secretary, MTEA
3	Prof. Dr. Letha P. Cheriyan	Principal, MTCW
4	Mr. P.K. Kuruvilla	College Treasurer
5	Prof. Abraham P. Mathew	MTEA Correspondance Secretary
6	Rev. Dr.Thomas Kurian Anchery	Member
7	Dr. Abey Thomas Varicad	Treasurer MTEA
8	Mrs. Lalamma Mathew	Member
9	Adv. Jessy George	MTEA Representative
10	Ms. Biji Mathew	MTEA Representative
11	Dr. Rajan Varughese	Member
12	Prof. M.Thomas Mathew	Nominated Member by Metropolitan
13	Dr. Rajeev Thomas	Principal, Mar Thoma College, Chungathara
14	Dr. Niji C. I.	Nominated Member, Kottayam Kochi Diocese
15	Mrs.Rachel George	General Secretary, Mar Thoma Suvisesha Sevika Sangham
16	Dr. Minu Susan Koshy	Staff representation to Governing Council
17	Mr. Jibin Shibu Sam, Bursar	Special invitee

Table 2.1 College governing body

2.8 COLLEGE COUNCIL

Sl.No	Name	Designation
1	Prof. Dr. Letha P. Cheriyan	Principal (Chairperson)
2	Dr. Minu Susan Koshy	Head, Department of English (Secretary)
3	Dr. Sujo Mary Varghese	Head, Department of Commerce
4	Dr. Anupama P.	Head, Department of Physics
5	Dr. Shalitha Jacob	Head, Department of Mathematics
6	Ms. Reemy Sara Mathai	Head, Department of Zoology
7	Dr. Shalitha Jacob	Head, Department of Chemistry
8	Dr. Vinod V	Head, Department of History
9	Dr. Vineed Kumar	Head, Department of Physical Education
10	Ms. Supriya Susan Kurien	UGC- Librarian
11	Ms. Bindhu Mathew	Junior Superintendent, College Office

Table 2.2 College Council

2.9 COLLEGE STAFF COUNCIL

Sl.No.	Name	Designation
1	Prof. Dr. Letha P. Cheriyan	Principal & Chairperson
2	Dr. Vineed Kumar K.	HoD, Physical Education
3	Dr. Sujo Mary Varghese	HoD, Commerce
4	Dr. Shalitha Jacob	HoD,Mathematics, Chemistry
5	Dr. Anupama P.	HoD, Physics
6	Ms. Reemy Sara Mathai	HoD, Zoology
7	Dr. Minu Susan Koshy	HoD, English & Secretary, Staff Council
8	Dr. Vinod V.	HoD, History
9	Dr. Bibin Kuriakose	Elected Staff Rep.
10	Mr. Jibin Shibu Sam	Elected Staff Rep.
11	Dr. Rinu Elizabath Philip	HoD, Hindi
12	Mr. Jiju John Y.	HoD, Malayalam
13	Ms. Supriya Susan Kurian	UGC Librarian
14	Ms. Bindhu Mathew	Superintendent, Office

Table 2.3 College staff council

2.10 IQAC

Internal Quality Assurance Cell (IQAC) functions as the pivotal point of coordination and monitoring of quality assurance, quality enhancement and quality sustenance of the college life. For this purpose, various committees and tasks are to be subsumed under the ten criteria of quality assessment.

Sl.No.	Name	Designation
1	Prof. Dr. Letha P. Cheriyan	Principal & Chairperson
2	Dr. Vineedkumar K.	IQAC Coordinator
3	Roshin T. Roy	IQAC Secretary
4	Ms. Chaithanya Elsa Achankunju	Curriculam Design Convenor
5	Dr. Avani T.	Faculty Resources Convenor
6	Dr. Sujo Mary Varghese	Infrastructure Convenor
7	Mr. Jibin Shibu Sam	Financial Resources & Management Convenor
8	Dr. Anupama P.	Learning and Teaching Convenor
9	Ms. Sherin T. Abraham	Extended Curricular Engagements Convenor
10	Lt. Dr. Sangeetha Rachel Koruth	Governance and Administration Convenor
11	Dr. Jismy Varghese	Student Outcomes Convenor
12	Dr. Minu Susan Koshy	Research and Innovation Outcomes Convenor
13	Ms. Reemy Sara Mathai	Sustainability (Green initiatives) Convenor

Table 2.4 IQAC representatives of the college

2.11 ACADEMIC PROGRAMS

The college offers a diverse range of programs, including eight undergraduate courses and two postgraduate courses. The undergraduate programs include B.Sc. Mathematics (1991), B.Sc. Zoology (1993), B.Com – Finance and Taxation (1995), B.Com – Computer Applications, B.A. History (Vocational Archaeology and Museology) (1998), B.A. English (Vocational Administrative Assistant) (1999), B.Sc. Physics (Vocational Applied Electronics) (2001), and B.Sc. Chemistry (Model I) (2006). At the postgraduate level, the college offers M.Sc. Zoology and M.Sc. Mathematics. Additionally, the institution provides an Integrated Programme in Basic Science – Physics and UGC-sanctioned BVoc courses in Fashion Technology and Merchandising, and Tourism and Hospitality Management.

Program	Courses/Discipline	Details
I Four Year Under Graduate Programes (MGU-UGP)	Foundation Courses	AEC–ENG (Ability Enhancement Course) AEC-OL- (Other Language)–Hindi/ Malayalam MDC (Multi Disciplinary Courses) – Malayalam, Hindi, English, History, Physics, Commerce Finance & Taxation, Mathematics, Statistics, Physical Education, Commerce Co-operation (Self Financing)
	Pathway Courses	Major Courses (DSC A) – English, History, Physics, Zoology, Commerce Finance & Taxation, Chemistry, Mathematics, Commerce Co-operation (Self Financing) Minor Courses (DSC B)- English, History, Economics, Physics, Zoology, Botany, Commerce Finance& Taxation, Chemistry, Mathematics, Statistics, Commerce Co-operation (Self Financing)
II Under Graduate Programmes (CBCS)	ENGLISH Model II	Vocational-Administrative Assistant [Aided]
	HISTORY Model II	Vocational-Archaeology & Museology [Aided]
	COMMERCE Finance & Taxation Model I	[Aided]
	COMMERCE Computer Application Model I	[Self financing]
	MATHEMATICS Model I	[Aided]
	ZOOLOGY Model I	[Aided]
	PHYSICS Model II	Vocational-Applied Electronics [Aided]
	CHEMISTRY Model I	[Aided]

Vocational courses	Fashion Technology & Merchandising	[Self financing]
	Tourism & Hospitality Management	[Self financing]
III Post Graduate Programmes	MATHEMATICS	[Aided]
	ZOOLOGY	Specialization- Environmental Science [Self financing]
IV Integrated P.G. Programmes	PHYSICS	Integrated M.Sc. Programme in Basic Science [Aided]

Table 2.5 Academic of the college

2.12 ORGANOGRAM

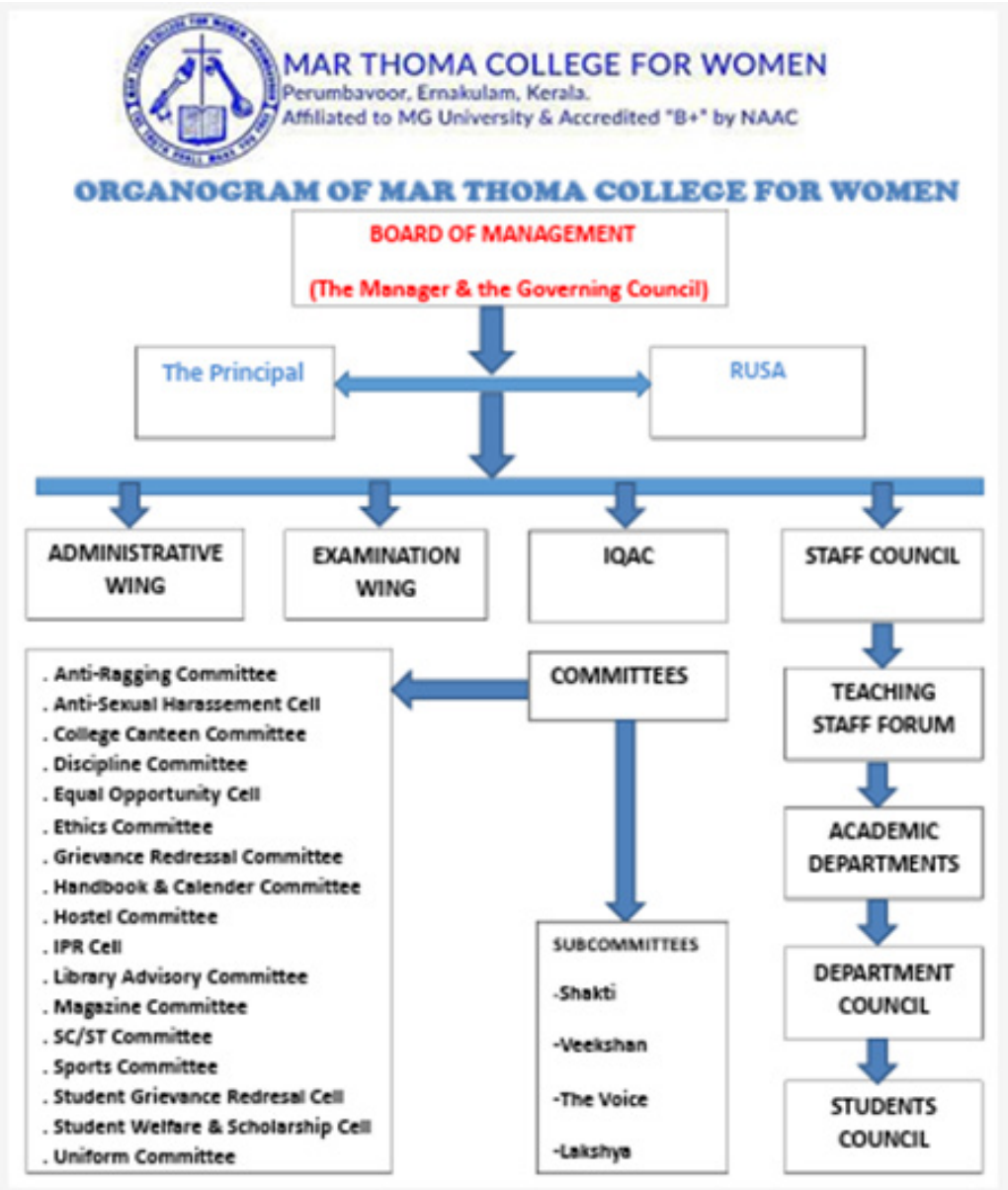


Fig 2.1 Organogram of the college

2.13 STRENGTH OF THE COLLEGE

2.13.1 Student Strength (2024-25)

Sl.No.	Department	Number of Students		Total
		Female	Male	
1	B.A.English	48	0	48
2	B.A. History	71	0	71
3	Commerce- Finance & Taxation	96	0	96
4	Commerce- Computer Application	54	0	54
5	B.Sc. Zoology	22	0	22
6	B.Sc. Physics	14	0	14
7	B.Sc. Mathematics	22	0	22
8	B.Sc. Chemistry	30	0	30
9	B.Voc. Fashion	15	0	15
10	B.Voc. Tourism	06	0	06
11	Integrated M.Sc. Physics	16	0	16
12	M.Sc.Zoology	19	0	19
13	M.Sc. Mathematics	14	0	14
TOTAL				427

Table 2.6 Total students' strength

2.13.2 Teaching Staff (2024-25)

Sl.No.	Department	Permanent		Management/Contract		Total
		Female	Male	Female	Male	
1	English	5	0	1	0	6
2	History	0	2	0	1	3
3	Archeology	0	1	0	0	1
4	Economics	0	0	1	0	1
5	Hindi	1	0	1	0	2
6	Malayalam	0	1	1	0	2
7	Commerce	4	1	4	0	9
8	Zoology	2	0	5	0	7
9	Botany	0	0	1	0	1
10	Physics	3	1	3	1	8
11	Mathematics	3	1	3	0	7
12	Statistics	1	0	0	0	1
13	Chemistry	0	0	3	0	3
14	Physical Education	0	1	0	0	1
15	Vocation Studies	0	0	6	0	6
TOTAL						58

Table 2.7 Total teaching staff strength

2.13.3 Non-Teaching Staff (2024-25)

Sl.No.	Category	Permanent		Management/Contract		Total
		Female	Male	Female	Male	
1	Library Staff	1	1	1	0	3
2	Lab Assistant	2	2	0	0	4
3	College Office	2	3	4	0	9
4	Office Attendants	1	2	1	0	4
5	Maintenance Staff	0	0	3	1	4
6	Security staff	0	0	0	2	2
7	Canteen	0	0	2	1	3
8	IIELT computer center	0	0	2	0	2
9	Hostel	0	0	3	0	3
10	Counsellor	0	0	1	0	1
TOTAL						35

Table 2.8 Total non-teaching staff strength

2.13.4 Total strength of college community (2024-25)

Sl.No	Category	Number
1	Students	427
2	Teaching Staff	58
3	Non- Teaching staff	35
Total		520

Table 2.9 Total strength of the college

2.13.5 Detailed program of the college

2.13.5.1 Aided programs

Sl No	Department	Programme
1	ENGLISH	BA ENGLISH Model II
2	HISTORY	BA HISTORY Model II
3	COMMERCE	BCOM-Finance & Taxation Model I
4	MATHEMATICS	BSC MATHEMATICS Model I
5	ZOOLOGY	BSC ZOOLOGY Model I
6	PHYSICS	PHYSICS Model II
7	CHEMISTRY	BSC CHEMISTRY Model I
8	MATHEMATICS	MSC. MATHEMATICS
9	PHYSICS	INTEGRATED MSC PHYSICS

Table 2.10 Aided programs of the college

2.13.5.2 Unaided programs

Sl No	Department	Program
1	COMMERCE	B.Com.-Computer Application Model I
2	VOCATIONAL STUDIES	B.Voc. Fashion Technology & Merchandising
3	VOCATIONAL STUDIES	B.Voc.Tourism & Hospitality Management
4	ZOOLOGY	M.Sc. ZOOLOGY

Table 2.11 Unaided programs of the college

2.14 CAMPUS LOCATION & LAYOUT

Fig 2.2 Camus layout of the college

1 - Main academic block
2 - Auditorium
3 - Fitness center
4 - Sick room and wash area
5 - Canteen
6 - Hostel
7 - Badminton court
8 - Basketball court
9 - Library
10 - IIELTS Computer center
11 - Playground
12 - Vidyavanam
13 - NCC Obstacle training and Firing ground
14 - Organic farming space
15 - Cottage
16 - Fruit garden
17 - Butterfly garden

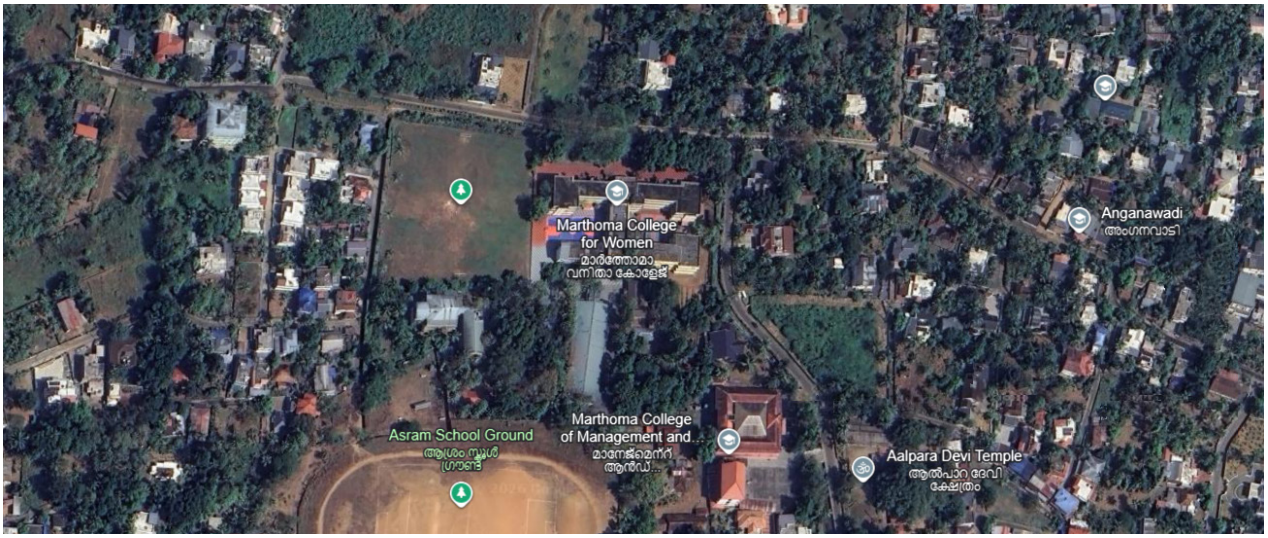


Fig 2.3 Campus Map & Location (Add using google ma'am and Google Earth)

2.15 FACILITIES OF THE COLLEGE

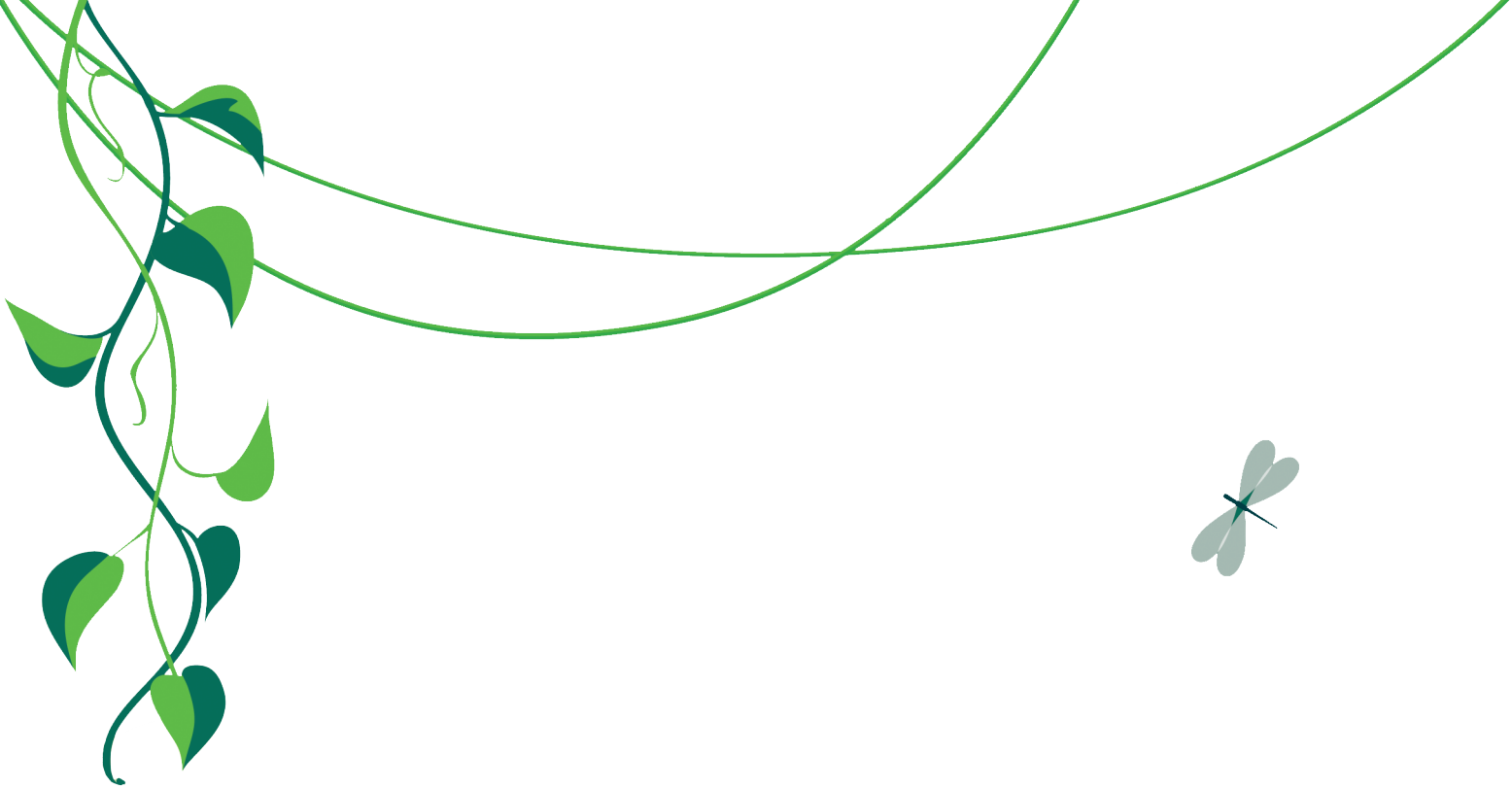
Sl.No	Facilities	Count
1	College Hostel	1
2	Auditorium	1
3	Mini conference hall / Board room	2
4	Seminar hall	1
5	Exam Hall	
6	Library	1
7	Lab	5
8	Computer lab	3
9	NSS Room	1
10	NCC Rom	1
11	Parking Lots	2
12	Fitness Centre	1
13	Green Spaces	4
14	Canteen	1
15	Sick-room	1
16	70,000 sq.ft. Playground	1
17	Basketball court	1
18	Table tennis/ Badminton court	1
19	Reprography Centre	1

Table 2.12 Facilities of the college

2.16 Inmates of the College hostel (2024-25)

Sl.No.	Number of Hostel	Inmate Category		Total
		Students	Staff	
1	Only 1 Girls Hostel	50	4	54

Table 2.12 College hostel strength



There is no such things as away.
When we throw anything away
it must go somewhere

- Annie Leonardv

Chapter III

ENVIRONMENT MANAGEMENT SYSTEM (EMS) : AUDIT REPORT

TIES

MAR THOMA COLLEGE FOR WOMEN PERUMBAVOOR
THE TRUTH SHALL MAKE YOU FREE

ENVIRONMENT MANAGEMENT COMMITTEE (EMS 2025-26)

Prof. Dr. Letha P. Cheriyan
Principal
Dr. Vineedkumar K.
IQAC Coordinator
Mrs. Reemy Sara Mathai
Green audit convener
Mrs. Bindhu Mathew
Office Superintend
Mrs. Feba P Baby
Office representative
Ms. Ansala Basheer
Student Representative
Ms. Afna Salim
Student Representative

3

Environment Management System : Audit Report

3.1 ENVIRONMENT MANAGEMENT POLICY

3.1.1 Statement of commitment

Mar Thoma College for Women, Perumbavoor, reaffirms its unwavering commitment to environmental stewardship and sustainable development by adopting this comprehensive Environment Management Policy (EMP). Recognising the pressing global ecological challenges of climate change, biodiversity loss, pollution, and public health risks, the college embraces a holistic approach that integrates conservation, education, research, innovation, and accountability into all institutional activities.

The Environment Management Committee (EMC), functioning under the strategic guidance of the Internal Quality Assurance Cell (IQAC), shall coordinate institutional efforts across the following five core thrust areas:

A. Biodiversity Management
B. Water Management
C. Waste Management
D. Energy Management
E. Occupational Health and Safety (OHS)

This policy aims to institutionalise sustainability across academic, administrative, operational, and community engagement dimensions, thereby fostering a green and resilient campus ecosystem.

3.1.2 Goals

- Preserve native species and habitats, support ecological balance, and promote awareness and community participation in conservation.
- Reduce consumption, improve efficiency, and encourage reuse through sustainable water management technologies.
- Minimise waste generation, enhance segregation, and promote a circular economy approach.
- Reduce carbon footprint by integrating energy-efficient systems and renewable energy solutions.
- Ensure a safe, inclusive, and health-conscious environment for all campus stakeholders.

3.1.3 Objectives

- Drive energy efficiency and renewables in all infrastructure and operations, reducing consumption

and embedding sustainability in academics and outreach.

- Conserve and reuse water through efficient systems, infrastructure upgrades, monitoring, and education.
- Cut waste via sustainable procurement, segregation, reuse, recycling, and waste-conscious infrastructure design.
- Enhance biodiversity with green infrastructure, native species support, research, and community partnerships.
- Ensure health, safety, and risk mitigation through preventive measures, compliant infrastructure, and a secure campus environment.

3.1.4 Resource Management

- The college has established a comprehensive Energy Management System (EnMS) in alignment with sustainable development goals to drive efficiency across campus infrastructure and operations. Core actions include adopting clean energy solutions such as solar power, using energy-efficient appliances, and installing LED lighting to reduce wastage. Regular inspections, MCCBs for electrical safety, and compliance with Bureau of Energy Efficiency (BEE) standards ensure reliability and regulatory alignment. Energy literacy is embedded into academic programs and supported by eco-visual signage, workshops, and awareness campaigns, reinforcing behavioural change toward sustainable energy use.
- Water stewardship at the college prioritises conservation, reuse, and infrastructure efficiency. Rainwater harvesting and groundwater recharge via percolation pits reduce dependence on external sources. Low-flow taps and structured maintenance protocols supported by flow meters for monitoring further strengthen water management. Awareness programs and training promote water literacy among students and staff, while expansion of non-potable water systems for gardening and cleaning aligns with Sustainable Development Goal 6 (Clean Water and Sanitation).
- An integrated waste management approach minimises waste generation and maximises reuse and recycling across the campus. Segregation at source, composting of biodegradable waste, and sustainable procurement practices reduce the volume sent to landfills. Waste-conscious infrastructure, regular audits, and preventive maintenance ensure long-term efficiency. Students and staff are actively engaged through signage, campaigns, and training sessions, while periodic quality assessments reinforce compliance with national and institutional sustainability standards.
- Biodiversity conservation underpins the college's green infrastructure strategy. Initiatives include fruit tree plantations, butterfly gardens, medicinal gardens, Vidyavanam, a nature-heritage zone that enhances ecological richness and serves as an outdoor learning space. Biodiversity audits and Environmental Impact Assessments (EIA) are conducted before any infrastructure development to prevent habitat disruption. QR-coded plant tags, biodiversity registers, and research-based field surveys integrate conservation into teaching and research, advancing Sustainable Development Goal 15 (Life on Land) and the Biological Diversity Act.
- The college maintains a proactive Occupational Health and Safety framework to create a secure and inclusive environment for students, staff, and visitors. This includes clear policies, regular drills, fire safety and first aid training, and monitoring of noise and other potential hazards. Accessibility is embedded in infrastructure through ramps, handrails, and signage, while wellness initiatives promote mental and physical health. Preventive maintenance, structured inspections, and digital communications from the principal ensure timely updates, issue escalation, and continuous improvement in campus safety and wellbeing.

3.1.5 Curriculum Integration

- Introduce course modules and interdisciplinary content on biodiversity, sustainable water use, renewable energy, waste management, and health and safety.

- Promote project-based learning, including biodiversity mapping, water audits, energy surveys, and waste tracking.
- Conduct life skill programs on first aid, personal safety, and mental health.
- Involve students in eco-clubs, NSS, and department-level green initiatives that reinforce classroom knowledge with hands-on experiences.
- Encourage student research, fieldwork, and dissertations aligned with the college's environmental goals.

3.1.6 Green Initiatives

- Develop eco-friendly infrastructure, including LED lighting, solar panels, rainwater harvesting units, compost pits, and greywater recycling systems.
- Promote plastic-free campus practices, waste segregation stations, refill stations, and sustainable procurement policies.
- Establish thematic spaces like Miyawaki forests, butterfly gardens, and organic farms.
- Mandate environmental impact assessments (EIA) for all major construction and infrastructure projects.
- Implement energy-saving measures, including sensor-based appliances and vehicle-pooling schemes.

3.1.7 Purchasing and Procurement

- The College's Purchase and Procurement Policy integrates sustainability and ethical responsibility into every purchasing decision. Environmental, health, and social considerations guide the selection of products and services, emphasising energy-efficient systems and equipment under the expertise of the energy management team to reduce overall consumption. Water conservation is supported through the use of low-flow taps, sourcing drought-tolerant native plants, and procuring materials that enable rainwater harvesting and other reuse initiatives, all monitored through regular audits.
- Waste reduction is addressed through pre-purchase optimisation led by the Waste Management Committee, which promotes minimising plastic and hazardous materials, replacing single-use products with reusable alternatives such as steel utensils and cloth bags, and enforcing a Green Protocol for campus events. Sanitary waste is managed responsibly, while biodiversity is supported through eco-conscious landscaping that prioritises native species and limits pesticides and fertilisers.
- This integrated approach favours certified green products, eco-labelled materials, and suppliers with strong corporate social responsibility records that support conservation and local community welfare. Input from institutional committees such as EnMS, WEMS, WMS, and OHS ensures minimal environmental impact, reduced resource consumption, and responsible, ethical procurement practices across the campus.

3.1.8 Research and Innovation

- Encourage faculty and student projects and dissertation topics on ecological restoration, climate resilience, clean energy, greywater reuse, behavioural waste reduction strategies, and occupational health.
- Use real-time campus data from sensors, audits, and surveys as live research material.
- Support publication and dissemination through institutional journals, conferences, and environmental forums.
- Facilitate externally funded research and industry-academia collaborations for sustainable innovation.
- Leverage findings to develop evidence-based policy updates for the EMS.

3.1.9 Community Engagement

- Conduct awareness campaigns, training workshops, and outreach programs for local communities on water saving, waste reduction, renewable energy, and hygiene.

- Implement village adoption programs and organise public health campaigns (e.g., menstrual hygiene, mental wellness).
- Offer technical guidance to residents on installing domestic rainwater collection and composting systems.
- Collaborate with local bodies (e.g., Perumbavoor Municipality, Suchitwa Mission) for joint environmental actions and sustainable initiatives
- Host eco-fairs and open-house exhibitions showcasing student innovations and research in sustainability.

3.1.10 Monitoring and Reporting

The institution will develop a comprehensive, integrated system to monitor and report on environmental performance across all core areas: energy, water, waste, biodiversity, and occupational health and safety (OHS). Each focus area will feature clearly defined Key Performance Indicators (KPIs) aligned with policy objectives and audit requirements. A centralised Environmental Management System (EMS) dashboard will consolidate data from all departments, enabling real-time tracking, analysis, and transparent reporting. Periodic audits will be carried out in each area to assess compliance, identify risks, and capture best practices.

- **Energy:** Consumption will be monitored through internal audits of meter readings, utility bills, and departmental inventories, with findings compiled in an annual Energy Performance Report prepared by the audit team.
- **Water:** Usage will be tracked via designated representatives, flow meter data, and infrastructure evaluations.
- **Waste:** Managed by the Waste Management Committee using monthly audits, inspections, and CCTV monitoring.
- **Biodiversity:** Progress documented through continuous surveys, registers, and conservation records.

Progress and effectiveness will be reviewed through quarterly meetings, inspections, and stakeholder feedback loops. Incidents, repairs, safety violations, and preventive measures will be centrally recorded to reinforce accountability and support data-driven decisions. This system will enable quick response to emerging issues, proactive risk management, and continuous improvement across departments.

An annual environmental report will be published, showcasing KPIs, consumption data, waste statistics, biodiversity records, and key achievements. Stakeholders, including students, faculty, and staff, will be actively engaged through surveys, awareness initiatives, and feedback tools, fostering a campus-wide culture of sustainability and accountability.

3.1.11 Compliance and Review

The College is committed to strict adherence to the Sustainable Development Goals, environmental laws and regulations at local, state, national, and international levels. This commitment extends across energy efficiency, water conservation, waste management, including hazardous waste, biodiversity protection and occupational health and safety. Policies and procedures in these areas will be reviewed regularly at least once every three years or more frequently when required to integrate regulatory changes, technological advances, audit findings and best practices.

Monitoring and accountability will be ensured through clearly defined departmental responsibilities and active oversight by internal audits and dedicated committees. These bodies will track compliance, identify gaps and implement corrective measures promptly. The Environmental Management System policy will also undergo periodic reviews, including an annual assessment of its efficiency, compliance status and technological updates to keep it relevant and effective.

Stakeholder engagement is central to this approach. Students, faculty, staff and external partners will be actively involved in reviewing policies and practices to ensure an inclusive and participatory process. Operational

guidelines, standard protocols, awareness initiatives, educational signage and enforceable measures, particularly in areas such as waste segregation and disposal, will reinforce compliance.

By combining regulatory compliance, strong monitoring, regular policy review and broad stakeholder participation, the College seeks to maintain a transparent, accountable and continuously improving environmental management system aligned with its sustainability goals and community expectations.

3.1.12 Leadership and Accountability

The Environmental Management System, comprising students, faculty, staff, and administrators, oversees the implementation and continuous evaluation of the College's environmental policies. A dedicated faculty member, serving as EMS Coordinator, reporting to senior leadership, manages all initiatives, tracks progress toward defined goals, and provides specialised technical guidance. The IQAC ensures that the Committee's functioning aligns with institutional quality standards. Thematic areas such as Energy, Water, Waste, Biodiversity, and Occupational Health and Safety are managed by designated faculty leads, supported by departmental green coordinators and student representatives. Each team is responsible for executing and monitoring sustainability policies, while roles for audits, reporting, and awareness programs are clearly defined across departments to maintain transparency and accountability. Departments and individuals are expected to meet defined targets in energy conservation, water efficiency, waste reduction, and biodiversity enhancement, with performance regularly assessed through audits and progress reviews.

To build capacity and promote engagement, training and skill-development sessions are conducted for faculty, staff, and student volunteers. High-performing departments and individuals are recognised and incentivised through green certifications and awards, fostering a culture of sustainability and excellence across the campus. A clear communication and decision-making framework ensures effective information flow. EMS-related matters are formally communicated by coordinators to Heads of Departments (HoDs) and College Union representatives, while staff and students report concerns through HoDs to the designated Committee Coordinators. These concerns are escalated to the EMS Convenor, who liaises with the IQAC Coordinator and the Principal. Where necessary, the Principal engages with College Management for decisions and implementation, ensuring that all aspects of the Environmental Management System are addressed efficiently and inclusively.

3.1.13 Conclusion

Mar Thoma College for Women, Perumbavoor, places environmental sustainability at the heart of its institutional vision, guiding its academic, operational, and community initiatives. The College's Environmental Management Policy seeks to cultivate awareness, minimise ecological impact, and promote responsible practices among students, faculty, and staff, fostering a campus culture that values environmental stewardship. The policy integrates sustainability across teaching, research, operations, and outreach. It is regularly updated through annual reviews, research-based insights, and inclusive feedback from all stakeholders, ensuring responsiveness to evolving environmental challenges and opportunities. Through proactive engagement, capacity-building, and continuous improvement, the College aims to establish a safe, sustainable, and inclusive campus environment. This approach reinforces accountability, encourages responsible action, and contributes to a healthier, more sustainable future for both the campus community and the broader society.

3.2 ENVIRONMENT MANAGEMENT PLAN (EMP)

3.2.1 Statement of Commitment

Mar Thoma College for Women, Perumbavoor, reaffirms its steadfast commitment to promoting environmental stewardship, sustainable practices on campus, and holistic well-being, in line with international organisational standards and Sustainable Development Goals (SDGs). Guided by principles of ethical governance, scientific knowledge, and community involvement, our Environment Management Plan (EMP) embodies

our vision of becoming an environmentally responsible academic institution. The Internal Quality Assurance Cell (IQAC) provides oversight, ensuring a structured, accountable, and adaptive framework for our initiatives.

3.2.2 Establish an Environment Management Team

- The EMS Coordinator functions as the key link between the IQAC and the EMS subcommittees, ensuring effective communication and coordination. This position involves overseeing the implementation of policies, incorporating sustainable development goals, maintaining detailed documentation, and carrying out regular assessments to pinpoint areas for improvement and ensure accountability
- Committee Convenors lead the five essential EMS areas: Biodiversity, Water, Waste, Energy, and Occupational Health & Safety (OHS), driving initiatives and strategies specific to each domain. They plan targeted actions, monitor performance indicators, and report results to the EMS Coordinator for unified institutional reporting.
- Faculty and Technical Staff play a supportive role by executing policy initiatives, managing documentation, and engaging in audit procedures. Non-Teaching Staff Representatives guarantee compliance in the management of facilities and everyday operations, while Student Representatives engage actively in planning, awareness-raising campaigns, and the promotion of environmentally friendly practices across the campus.

3.2.3 Objectives

- Foster an environmentally conscious academic ecosystem through integrated, measurable strategies.
- Promote optimal resource utilization, sustainable infrastructure, and conservation.
- Inculcate environmental values through curricular, co-curricular, and outreach efforts.
- Strengthen stakeholder participation through inclusive governance and feedback systems.
- Ensure continuous improvement through reviews, audits, and research-based interventions.

3.2.4 Formulation of Comprehensive Strategy

Each EMS domain operates on a strategic framework comprising:

- An effective sustainability program reinforces baseline assessment tools. These tools include thorough biodiversity audits for documenting local plant and animal life, detailed evaluations of energy conservation practices and water use to measure consumption patterns, systems for tracking waste generation and disposal, and health risk mapping to pinpoint potential environmental threats. Setting up these metrics provides a solid foundation for tracking progress and identifying key areas for action.
- The program's implementation is guided by specific standard operating procedures (SOPs) for different domains and customised environmental indicators. These SOPs set out clear protocols for various operational aspects, such as procurement, maintenance, and waste management. Meanwhile, indicators like carbon intensity, water efficiency ratios, and waste diversion rates facilitate focused monitoring. This organised strategy ensures that sustainability efforts are practical and measurable across different functions.
- For effective execution, specific responsibilities need to be established across departments and stakeholders, with cross-functional teams assigned particular tasks—from facilities overseeing infrastructure improvements to procurement favouring environmentally friendly suppliers. Leadership oversight and regular inter-departmental meetings promote alignment. Additionally, collaboration with municipal authorities, NGOs, and state/national agencies enhances impact through shared resources, policy initiatives, and regional projects, creating a ripple effect that extends beyond the organisation.
- Modules centred on environmental and sustainability topics are integrated into at least

five academic programs. Project-based learning activities, including water resource management , biodiversity mapping, and energy tracking solutions, are incorporated to enhance practical engagement. Life skills education encompasses critical subjects such as disaster preparedness, first-aid, and hygiene management. Organizations like NSS, Eco Club, Nature and Heritage Club, along with various student associations, actively facilitate field-based activities and environmental events. Additionally, internships, minor research projects, and dissertations focusing on Environmental Management System (EMS) themes are promoted across different disciplines.

- Resource management initiatives should focus on investing in high-quality and durable products. Acknowledging these requirements necessitates infrastructure upgrades in water and energy systems, as well as efforts to conserve biodiversity and maintain the natural atmosphere of the college. The existing systems must be centralised to ensure the safety and security of the college community. Aim to develop a sustainable campus network aligned with the Sustainable Development Goals (SDGs) with the ultimate objective of achieving a carbon-neutral campus.

3.2.5 Communication Channel and Governance Structure

Updates regarding the EMS are communicated through departmental meetings, electronic newsletters, notice boards, and student forums. Suggestions and concerns can be submitted through online forms, open forums, or suggestion boxes. Issues raised through the EMS are reported to the Staff Council and may be escalated to the Governing Body for appropriate action, based on their severity or significance. Monthly meetings of EMS subcommittees contribute to quarterly reviews conducted by the EMS Coordinator and IQAC. Critical issues are identified for prompt corrective action, accompanied by appropriate documentation.

3.2.6 Short-Term and Long-Term Goals

Short-Term (0–1 Year)

- Campus-wide audits for baseline data.
- Establish SOPs and install primary infrastructure (bins, signboards, water-saving devices).
- Launch campus-wide awareness drives and safety workshops.
- Create a reporting dashboard and inventory register for EMS-related activities.

Long-Term (1–5 Years)

- Achieve a 50% reduction in water and energy consumption.
- Attain full curriculum integration of sustainability principles.
- Establish research hubs for biodiversity and sustainable technologies.
- Transition toward renewable energy infrastructure.
- Institutionalise EMS as a replicable model for other academic institutions.
- Achieving net-zero emissions by 2035

3.2.7 Continuous Monitoring and Enhancement of the System

- Monitoring and Evaluation: Regular tracking by EMS domain committees (monthly/quarterly), annual third-party audits, stakeholder feedback, and departmental KPI reviews for compliance assessments and a checklist of each component.
- Utilisation of Recommendation: Utilisation of Recommendations: Align recommendations with policy following a thorough assessment of their significance and necessity for policy enhancements, while identifying best practices within the college to ensure long-term sustainability
- Annual Assessment and Transparency: The IQAC thoroughly reviews all findings and areas for improvement, ensuring that results are effectively communicated in the evaluation report, with guidance from the college governing body.

3.2.8 Conclusion and Follow-Up

This Environment Management Plan is a comprehensive, integrative framework aimed at fostering sustainability,

efficiency, and institutional accountability. With IQAC providing strategic oversight and the EMS operating through an inclusive governance model, Mar Thoma College for Women is poised to become a leader in sustainable campus development. The plan will be reviewed annually, informed by data, and refined through stakeholder feedback to ensure it evolves in response to emerging environmental and institutional challenges.

Chapter IV

ENERGY MANAGEMENT SYSTEM (En MS): AUDIT REPORT

ENERGY MANAGEMENT SYSTEM COMMITTEE (EnMS 2025-26)

Dr. Anupama P.
Dr. Rajani Jacob
Dr. Paulose Thomas
Ms. Aiswarya K.R.
Assistant Professor

Aparna Chandran
Neha Josh
Leedhiya Jiji
Vaishnavi D.S.
Johanna Susan John
Adithya P.
Anupriya S. Raj
Students

4

Energy Management System: Audit Report

4.1. INTRODUCTION

Energy plays a vital role in our everyday lives, meeting a fundamental human requirement. It supports nearly every aspect of our daily activities, and our planet offers a range of energy sources, each with unique features. Nevertheless, all energy sources have environmental effects, and different factors contribute to these ecological impacts. This article explores various energy sources and their environmental effects. The relationship between energy and environmental issues is closely linked, as the production, distribution, and utilisation of energy invariably result in significant environmental consequences. The immediate impacts of energy consumption encompass air pollution, climate change, water pollution, thermal pollution, and solid waste generation. Specifically, the burning of fossil fuels is a major factor in urban air pollution and a primary source of greenhouse gas emissions. Furthermore, activities related to energy often contribute to water pollution concerns.

Electrical systems consist of intricate networks of wiring and safety mechanisms that supply power to numerous applications, such as heating, ventilation, and air conditioning (HVAC) systems, fans, pumps, computers, lighting, blowers, compressors, and heavy machinery. However, factors like aging components, dust buildup, humidity, and outdated technology can reduce their efficiency. These challenges result in energy losses, as electricity may be converted into heat, diminishing efficiency and increasing power demand. Employing energy auditing methods can help address these inefficiencies by evaluating the overall functionality of the electrical system.

ISO 50001 allows organisations to systematically enhance energy performance across all processes by formulating strategies to efficiently manage energy usage while informing the public about their energy management initiatives. Energy auditing, performed in accordance with ISO standards and aligned with sustainable development goals, involves a comprehensive assessment of energy consumption in a particular area or building, targeting the identification of inefficiencies and the improvement of energy performance. The findings from the audit guide the development of effective energy management strategies aimed at reducing energy consumption while maintaining operational efficiency, comfort, and performance. Throughout the auditing process, variables such as occupant behaviour, the age of the building, and climatic conditions are meticulously analysed to deliver precise and actionable insights.

4.1.1 What is an energy Audit?

- Energy auditing is an essential tool for identifying opportunities and strategies to enhance energy efficiency. It is instrumental in revealing potential efficiency measures and assessing their economic viability across different operational levels. The process starts with a preliminary assessment that includes site inspections and general energy evaluations to uncover low-cost savings options. As the audits advance to more detailed stages, they analyze energy costs, consumption habits, and system characteristics more thoroughly, using on-site measurements to determine substantial efficiency improvements that align with tailored financial plans for the site. The prerequisites for conducting an energy audit are:
- A comprehensive assessment of the energy infrastructure at the college or university is essential.
- An in-depth analysis of the energy consumption patterns across various utility points, highlighting areas of energy loss or inefficiency.
- To identify potential energy-saving opportunities, which may involve behavioural changes, upgrades to energy-efficient infrastructure and equipment, as well as the integration of alternative energy sources.

Conducting such thorough energy audits not only lays the groundwork for establishing an Energy Management System (EnMS) within educational institutions but also enhances the overall management of energy demand.

4.1.2. Needs for Energy Audit

As sustainability becomes more important in our daily lives, there is a growing and sustained interest in professional energy management systems. This shift is driven by the recognition that saving energy and reducing CO_2 emissions can greatly support our climate and the environment. Recently, there have been noticeable changes in energy consumption trends. Beyond the goal of cutting electricity expenses, many organisations are now adopting advanced machinery and equipment designed for lower energy consumption. The need for an efficient infrastructure is becoming increasingly clear.

The functions of the energy audit are:

- An energy audit can reduce energy consumption
- An energy audit can reduce the energy bill and save money
- An energy audit can improve the comfort level
- An energy audit can reduce the carbon footprint
- An energy audit can reduce unnecessary waste and pollution

Customising energy audits to align with effective energy management systems can significantly reduce energy expenses, enhancing your financial flexibility. As a result, you gain a more comprehensive understanding of operational processes and consumption trends, which facilitates the rapid and sustainable implementation of enhancement strategies.

4.1.3 Benefits of adopting energy management system

An energy management system, ISO 50001, can provide

Organisations have several benefits. These include:

- Facilitating a structured approach to decrease energy usage and carbon emissions.
- Developing a comprehensive insight into current energy consumption to guide the formulation of new objectives and targets.
- Evaluating and prioritising the adoption of new energy-efficient technologies and methods.
- Providing a framework to improve energy efficiency throughout the complete supply chain.
- Offering guidance on how to benchmark, assess, document, and report on efficient energy use.
- Enhancing the performance of energy-consuming assets to identify potential cost-saving opportunities in maintenance or ways to boost capacity.

4.2. ENERGY MANAGEMENT POLICY

4.2.1 Introduction

Mar Thoma College for Women, Perumbavoor, fully acknowledges its institutional, social, and ecological

responsibility to mitigate environmental degradation through structured and accountable practices. This Energy Audit and Sustainability Policy is developed to guide the institution's commitment to sustainable development, emphasizing resource conservation, eco-conscious planning, and environmental awareness aligned with

4.2.2 Goals

The central goal of this policy is to operationalize sustainability through deliberate and measurable practices that align with key Sustainable Development Goals, including SDG 7 (Affordable and Clean Energy), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 15 (Life on Land).

4.2.3 Objective

- To decrease campus-wide electricity use by 5% every year, by enhancing energy efficiency by upgrading lighting and electrical infrastructure to LED systems, installing rooftop solar energy systems, and replacing outdated appliances with energy-efficient alternatives.
- To decrease the college's carbon emissions by adopting energy-efficient practices.
- To implement the Monitoring & Reporting System by collecting quarterly energy performance reports, including energy trends, anomalies, savings estimates, and recommendations.
- To upgrade its infrastructure by replacing conventional lighting systems with energy-efficient LED fixtures and equipping seminar halls with automated daylight sensors.
- Solar panels will be installed on the rooftops of the administrative block and hostels to offset grid dependency.
- The college will conduct annual audits of energy, in collaboration with accredited external agencies. These assessments will be documented and reviewed by a designated committee for corrective action.
- In procurement processes, the institution will mandate the purchase of only Energy Star-rated appliances and recyclable materials.
- Educational initiatives will include environmental communication campaigns, departmental green challenges, and student awareness programs.

4.2.4 Resource Management

4.2.4.1 Energy conservation initiatives: The college will implement a campus-wide lighting strategy focused on energy efficiency by replacing conventional bulbs with LED fixtures in classrooms, laboratories, and outdoor spaces. To further optimize usage, motion sensors, daylight-responsive controls, and timers will be installed in shared areas. Upcoming buildings and major renovations will adhere to advanced green architectural standards designed to minimize electricity consumption. Additionally, rooftop solar panels will be installed across academic blocks, hostels, and administrative facilities to promote the use of renewable energy and reduce reliance on non-renewable sources.

4.2.4.2 Energy Infrastructure Strategies: As part of the core resource management strategy, the college will conduct regular energy audits to identify inefficiencies and optimize energy usage. Campus infrastructure will be systematically assessed and maintained to minimize energy loss and enhance operational performance. Aging electrical distribution systems will be upgraded to improve efficiency, star-rated, and reduce transmission losses. Additionally, smart meters and sub-meters will be installed in all major buildings to enable real-time monitoring of energy consumption by department or functional area.

4.2.5 Green Initiatives

4.2.5.1 Smart mobility approach: To institutionalize environmental sustainability, the college will introduce a structured vehicle-sharing system supported by a campus-wide registration and scheduling platform to reduce carbon emissions from individual transport.

4.2.5.2 Tree planting drive: The campus will initiate carbon sequestration efforts by planting trees annually in designated green zones and ensuring their maintenance through a student-led adoption program.

4.2.5.3 IEC initiatives: Awareness programs will be organized on campus, encouraging students and staff to unplug devices, switch off lights, and reduce HVAC use.

4.2.6 Research and Innovation

The institution will promote an environment in which faculty and students are encouraged to engage in research projects centered on themes such as the implementation of renewable energy. Annually, the institution will facilitate at least one major multidisciplinary research initiative and allocate internal funding to support smaller, classroom-based studies. Additionally, we will hold seminars and workshops each year to educate both students and staff on sustainable practices and to foster participation in energy-saving initiatives. The college will also host hackathons and innovation competitions targeting challenges in electrical energy, motivating students to develop technology-driven solutions that enhance energy efficiency and facilitate the integration of renewable resources.

4.2.7 Curriculum Integration

Sustainability principles will be firmly embedded in the academic curriculum through the introduction of credit-based environmental science modules across undergraduate programs. Online courses on energy conservation, climate change adaptation, and circular economy models will be made available to all students and faculty.

Add-on certification courses will be offered in collaboration with external experts on topics such as green building design, environmental impact assessment, solid waste management, and energy conservation. The college will encourage interdisciplinary student research by making real-time energy audit data available for use in classroom projects, practical assignments, and dissertations.

LED bulb and solar lamp making training will be conducted for students, staff, and nearby communities to balance the limited budget production and utilize the service for the institution, and equip students to generate income from facilities, possibly for future enhancement of technology in the field of LED

4.2.8 Purchase and Procurement

The college is committed to acquiring energy-efficient equipment, materials, and systems that reduce overall electricity consumption and promote long-term cost savings. All departments and units are required to prioritize the purchase of appliances, electronics, lighting, and other electrical equipment that meet or exceed recognized energy efficiency standards. Wherever applicable, ensure the purchase of products that will be star rated or certified under equivalent national or international efficiency programs.

The Energy Management Team will regularly review purchasing data to ensure compliance with the energy policy. Procurement performance related to energy efficiency will be reviewed annually and included as part of the college's broader energy reporting process.

4.2.9 Community Engagement

The college will actively work with non-governmental organizations, local self-governing bodies, and research institutions to extend the impact of its sustainability programs. Collaborative workshops will be conducted for residents on energy-efficient practices.

The college will organize workshops on home energy audits, solar panel installations, and promote the advantages of electric vehicles as part of its community outreach programs.

The institution will organize regular community outreach activities, including LED lamp distribution drives and door-to-door awareness programs in collaboration with neighboring Panchayaths.

The college also plans to conduct energy audits in local schools and public buildings as part of its outreach, with students serving as trainee auditors under the supervision of certified professionals.

4.2.10 Monitoring and Reporting

A structured mechanism will be instituted to monitor progress and address shortcomings in policy implementation. Internal audit will be conducted by providing checklists, checking meter readings, reviewing bills etc., to track energy usage. The results will be

compiled into reports for administrative review. Data collection and checking will be done for each and every building and department. Each building will be equipped with smart meters to track electricity consumption daily, and deviations from expected values will be flagged for immediate corrective measures.

A grievance redressal framework will be established to allow students, faculty, or staff to report concerns on the misuse of energy resources. All reports will be addressed within seven working days and documented along with corrective actions taken.

The administration will regularly evaluate compliance through internal audits and align campus practices with new government regulations or technological developments. Meetings of the energy management committee will be held every quarter to review performance indicators and recommend improvements.

4.2.11 Compliance and Review

Each academic and administrative department will undergo a compliance review periodically to assess adherence to energy use protocols. If non-compliance is identified, corrective action plans will be developed in consultation with the department and the Energy Management Team. Operational compliance includes following lighting schedules and equipment usage protocols, especially during peak demand periods. Participation in energy-saving programs and demand response initiatives is mandatory for all relevant departments and units.

Feedback from stakeholders will be solicited for continuous improvement. The college will collect feedback from students, staff, and faculty through surveys and open forums to assess the effectiveness of the electrical energy policy and associated initiatives. This feedback will inform updates to energy-saving strategies and engagement programs.

4.2.12 Leadership and Accountability

The implementation of this policy will be overseen by an Energy Audit Committee comprising the Principal as Chairperson, a senior faculty member as Energy Coordinator, student representatives from each department, a technical consultant on energy systems, and an administrative officer.

The committee will maintain an Energy Audit Register and Minutes Book to record all sustainability-related actions, discussions, and decisions. These records will be stored both digitally and physically to ensure accountability and transparency.

An annual sustainability report will be published on the institutional website, summarizing energy consumption data, audit results, activities undertaken, and environmental goals achieved. A copy of this report will also be submitted to the College Governing Council, which will use the information to plan budgetary allocations and long-term infrastructure development.

4.2.13 Conclusion

Mar Thoma College for Women, Perumbavoor, envisions a future in which its educational mission is harmoniously aligned with ecological responsibility. By setting clear goals, ensuring strict monitoring, and integrating sustainability into every level of operation, the college aims to become a model for low-impact, high-resilience campuses in India.

This policy provides a structured roadmap for managing environmental inputs, increasing energy efficiency, and evaluating the long-term ecological impact of academic and administrative activities. Through active participation from students, faculty, administrators, and external stakeholders, the institution commits itself to a transformative journey that prioritizes sustainability, scientific accountability, and collective well-being.

4.3.METHODOLOGY

The energy audit systematically analysed the institution's energy usage according to a structured program. The 13 member of internal audit team, comprising 11 students and 2 faculty, collected data under faculty supervision.

4.3.1 Internal audit training

Green audit training fosters institutional ownership and engagement through comprehensive, participatory approaches. To prepare the college for this, the established Energy Management System (EnMS) selects students and faculty for internal audit training. This one-day program certifies them as internal auditors, qualifying them to conduct a waste audit. The internal energy audit process includes key stages: assessment, risk analysis, data collection, policy generation, and documenting registers

and programs for water conservation and resource management.

4.3.2. Power quality analysis

This assessment will evaluate the integrity of the facility's electrical system. A power quality analyser will be used to measure the power supplied by KESB, focusing on voltage variations, power levels, and harmonic distortion. Concurrently, a thermal imaging of single phase and three phase performed to check for thermal anomalies and verify load balancing across each phase, serving as a basis for preventive maintenance. The evaluation will conclude with an assessment of the equipment's accessibility for service and the clear identification of the emergency shutdown controls within the specified area

4.3.3. Registers and documents

The team initiated the energy audit by consolidating seven registers and five documents, including the energy audit training attendance sheet, auditor list, meeting records, and the institution's energy conservation plan and policy. Students received the task of mapping the campus and marking electrical appliances. To monitor usage, the team maintained various registers tracking energy meter readings, monthly utility bills, solar production, motor pump operations, and appliance logs. They also kept a maintenance register to assess appliance performance (effective/ineffective) and log daily/weekly operating hours. The process specifically focused on collecting weekend data and separate meter readings for each block.

4.3.4. Energy infrastructure documentation

Detailed documentation of the college's energy infrastructure (covering lighting, audio-visual equipment, lab instruments, computers, and appliances) was prepared. Subsequently, the total annual energy consumption was calculated in KWH using the power specifications of these items and their average yearly usage duration.

4.3.5. Usage pattern assessment through energy meter sampling data

Power consumption for each block was calculated by consolidating data collected centrally over three weeks, ensuring accuracy through daily and weekly cross-checks. This process involved multiple methods: energy meter readings taken three times daily during a nine-day period (covering weekends and a weekday), observational visits by team members to detail equipment, lighting, appliances, power capacities, and usage patterns, and interviews with the system manager and relevant faculty for operational context.

4.3.6 Analysis of KSEB meter reading

Power consumption data from the Kerala State Electricity Board (KSEB) were obtained from regular meter bills for the specified periods (2022-2023, and 2023-2024).

4.3.7 Identification of energy saving options and scope of alternate energy resources

The team identified and documented potential alternative energy sources and proposed a corresponding action plan. To assess the college's carbon footprint, they analysed the campus's energy resources including KSEB supply and alternatives along with their annual usage patterns across various locations like laboratories, offices, and kitchens.

4.3.8 External Audit

External auditors visit the college to evaluate conformity with energy management audit requirements and identify any non-conformities. If only minor non-conformities are found, the external auditor may then approve the institution for certification against relevant ISO standards.

4.3.9. Assumption

An effective Energy Management System (EnMS), when aligned with an organization's business strategy, provides crucial visibility into energy usage and highlights areas for performance improvement. It achieves this by establishing structured policies, processes, procedures, and action plans specifically designed to identify and implement energy-saving opportunities, fostering a culture of continuous improvement in energy management.

The primary benefit of an EnMS is tangible cost reduction. Energy savings identified through the system directly translate into lower energy bills, significantly reducing overhead. Many organizations implementing ISO 50001 report first-year savings that meet or exceed the initial investment, demonstrating a strong link between reduced energy consumption and improved financial performance. Furthermore, an EnMS deepens the understanding of where, when, and how energy is

consumed, enabling ongoing identification of efficiency improvements.

ISO 50001:2018, utilizing the Annex SL high-level structure, facilitates integration with other management systems like ISO 9001 (Quality) and ISO 14001 (Environmental). This allows for streamlined processes like document control, internal audits, and corrective actions, avoiding duplicated effort. A cornerstone of ISO 50001 is the comprehensive energy review, which forms the basis for determining Significant Energy Uses (SEUs) and identifying key efficiency opportunities.

Successful implementation hinges on management involvement. The standard requires setting clear energy objectives and measurable targets, considering SEUs and improvement opportunities. These must be monitored using tools like Energy Performance Indicators (EnPIs) compared against an Energy Baseline (EnB), then communicated and updated. Prescriptive data collection requirements ensure relevant information is gathered. Critically, ISO 50001 extends to the design and procurement of new or renovated energy-using installations, equipment, systems, or processes, embedding energy performance improvement throughout their lifecycle. Any significant deviations from expected energy performance must be investigated.

4.3.10.Stages of Energy audit

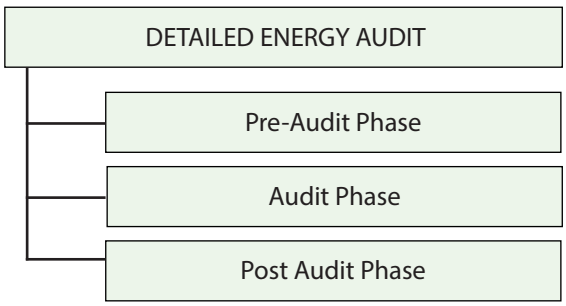


Fig. No. 4.1 An energy audit has three phases: pre-audit, audit, and post-audit.

1. Pre-Audit phase

- Formation of audit team; scheduling audit programmes
- Setting up of scope and objectives (in tune with energy policy of the institution)
- Discusses with the responsible persons of each location (staff, teachers, lab assistants, sweepers, watchmen, students etc.) about the usage pattern and habits related to energy consumption.
- Preparation of inventory of energy infrastructure- site diagrams, electrical diagrams, checklists etc.
- Analysis of consumption pattern; identification of energy loss or wastage

2. Audit phase

Auditors collect all data collected to ensure that nothing is overlooked completely in the audit. The following information has been collected during the audit phase:

- Collect the information about the source of the energy supply
- Collect the energy bills to find out the tariff data and electrical energy cost (monthly bills of last 24 months)
- Collect the load sector data (power ratings of equipment's, instruments, utilities etc.)
- Review of present energy management procedure-losses, wastage, options for improvement for energy conservation.

The outcomes of the collected data are:

- Preparing process flow diagram and energy, and material balance.
- Identification of Energy Conservation (ENCON) opportunities.
- Energy conservation & saving options and recommendations.
- Technical and feasibility report.
- Implementation plan for energy-saving measures and projects for the third phase (post-audit phase).

3. Post audit phase

- The plan of action for the post-audit phase is implementation and follow-up. The result is to assist and implement ENCON recommendation measures ad monitor the performance.

- EMS committee will ensure that the Energy Management System is in place and the college is participating, by making the entire college/ university community well informed through regular communications; monitoring through periodical evaluation programmes etc.

4.3.11.Steps of Energy Audit

1. Site assessment

Collection of contour maps and campus diagrams

- Preparing an inventory of energy infrastructure of each building:
    - Construction details of the building envelope (e.g. walls, roof, windows, doors and related insulation values)
    - Manual, time clock or automated control and measuring methods (energy meters, main switches; MCB, ELCB etc.)- control section; capacity; location etc.
    - Interior and exterior lighting systems and related controls
    - Equipment, appliances, instruments etc. – watts, utility pattern, average consumption (monthly or yearly)
    - Discussion with responsible persons of each infrastructure (on utility pattern, working condition, operation and maintenance procedures etc.)
    - Date entry in prescribed forms (Energy spread sheets)

2. Data analysis

- Analysis of current and past performance (energy bill comparison, previous audit data etc.)
- Regression analysis involves the comparison of energy consumption on the Y axis versus the potential energy driver on the X axis (weather, working days/holidays etc.).
- Preparation of checklists and verification
- Carbon credit calculation

3. Final audit by external audit team

- Checklists verification- identifying non-conformities
- Action plan –long tern and short term
- Final report & certification as per ISO standards.

The external audit conducted by TIES on 18th December 2025

4.3.12 Workplan and Schedule of Energy Audit

Week	Weekly Work Plan
13/03/2025 – 21/03/2025	A meeting took place to assess the policies and finalise the action plan. Each team member has been assigned the responsibility of reviewing the manual and creating checklists to execute the action plan. A comprehensive map of the college campus has been completed. Specific locations for meter readings have been determined. The internal audit team has been separated into ... groups. The campus has been segmented into three sections, with each group designated to survey a particular section.
24/03/2025 – 31/03/2025	Each team is tasked with locating the meters within their designated region. Each team has received a map that highlights the exact spots for collecting meter reading data. They are also required to identify and depict the electrical devices and instruments in their area using simple diagrams and line drawings. Data sheets have been distributed, and the data collection process will commence for each team next week.
01/04/2025 - 08/04/2025	Each team will be tasked with strategically placing registers in their designated areas to facilitate effective data gathering. They will also assess the performance of the appliances and tools they review. Based on performance metrics, devices will be categorised as either efficient or inefficient. A meeting will be arranged to evaluate the progress of the energy audit and to review the findings.
10/06/2025 - 21/06/2025	Compiling and submitting registers and documents, which will include detailing programs and activities, as well as taking notes during meetings.
24/06/2025 - 02/07/2025	Every group will be tasked with diligently tracking the operating hours of each appliance individually, documenting usage information daily and weekly, and including weekend details.
03/07/2025 - 12/07/2025	The power meter readings for every block should be noted at the same time. This week is set aside for calculating and noting the power meter readings for each block, which need to be recorded at the same time, utilizing data collected in the fourth week.
14/07/2025 - 19/07-2025	Power consumption data for all blocks must be gathered and compared with the power meter readings to identify any inconsistencies.

Table 4.1 Schedule of energy management audit

Energy Meter reading (for every meter in the college)	9 days; 3 times a day	Three Sundays; Three holidays (Saturday) Three working days 03/.07/2025 - 24/07/2025	Entry in the given format
Usage pattern of instruments, equipment, lights etc. Documentation of current ECM practices	Walk through audit and interviews with system managers (controlling or responsible staff or teachers)	One visit is enough in the assigned area. Collect data on power capacity and usage time of every light, fan, equipment, appliances, instruments etc.	Entry in the given formats
Alternate energy resources	Documents details of present alternate energy resources in the campus	Identify possible alternate energy sources	Entry in the given format Include in the action plan
List & details of energy resources in the campus	I. Electrical energy 1. KSEB supply per month 2. Alternate energy resources	Record the monthly/ annual usage quantity.	Keep registers. Data shall be entered in the given format
	II. Fossil fuels 1. LPG 2. Petrol/diesel 3. Kerosene etc.	Record annual usage with respective purpose uses and location 9lab, office, kitchen etc.)	Enter in the given format

Table 4.2 Workplan of energy management audit

4.4 RESULT AND DISCUSSION

4.4.1 Mandatory audit assessment

4.4.1.1 Enery performance

The Utility details are provided below:

Utility	Kerala State Electricity Board Limited
Consumer Number	1155836004590
Tariff	LT-6A/Three Phase
Contract Demand, kVA	42.166
Connected Load, kW	42.166
Electrical Section	Perumbavoor
Average Consumption, kWh	3396
Maximum Demand, kVA	29

Table 4.3 KSEB utility details of the college

Utility	Kerala State Electricity Board Limited
Consumer Number	1155834021297
Tariff	LT-6B/Three Phase
Connected Load, kW	20.886
Electrical Section	Perumbavoor
Average Consumption, kWh	1611

Table 4. 4KSEB utility details of the hostel

4.4.2 Historic Energy Analysis

The net energy used by the college is below:

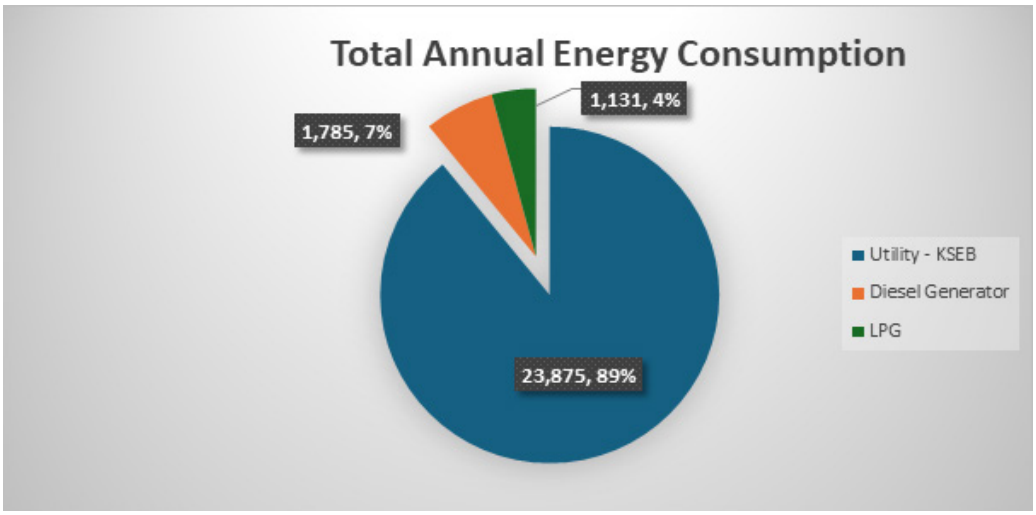


Fig 4.2 Annual energy consumption of the college

The energy analysis based on the utility electrical bill for the period starting from January 2025 to December 2025 is provided below.

College

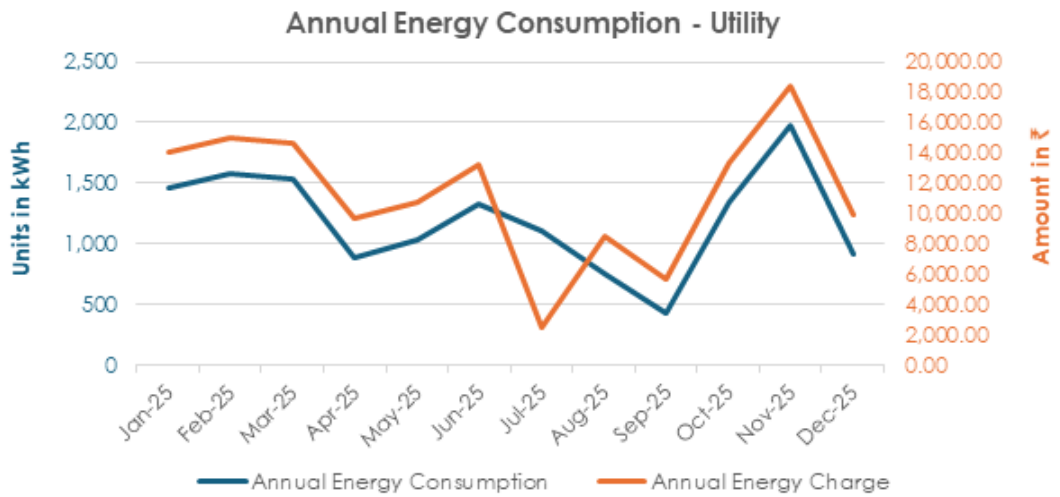


Fig 4.3 Annual energy consumption and charge of the college -2025

Hostel:

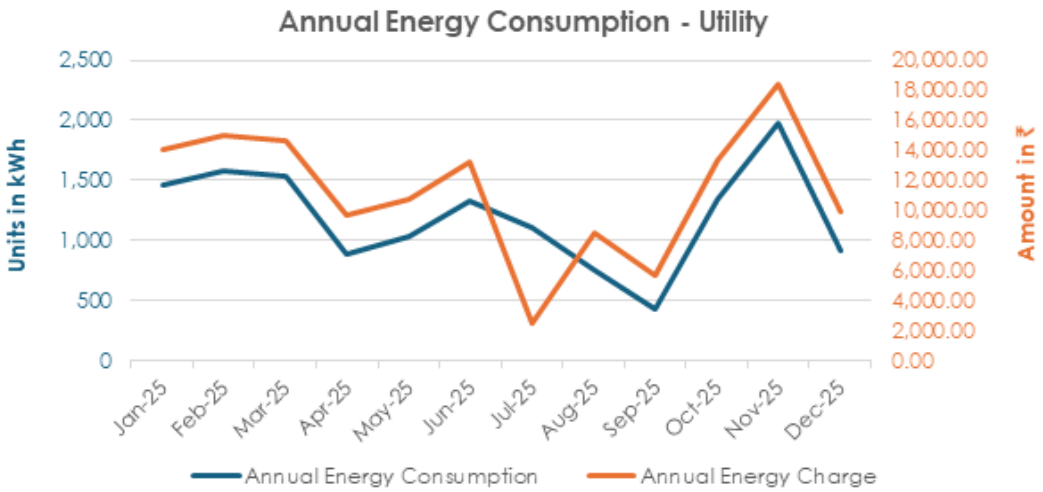


Fig 4.4 Annual energy consumption and charge of the hostel -2025

There are two charges in the energy bills, that is fixed charges and energy charges. The fixed charge is based on the demand and the energy charge is based on the energy consumption of the facility.

Zone	Time
Normal	6AM to 6PM
Peak	6PM to 10 PM
Off Peak	10 PM – 6AM

Table 4.5 24 Hours into three time zones of fixed charge

Fixed Charge:

For College – As the college falls in the category "Optional Demand Based Tariff for consumers other than those billed under tariff with connected load of and above 20kW" the fixed charge is 280/kVA/Month.

Contract Demand (CD), KVA	42
75% of Contract Demand, kVkA	35
130% of Contract Demand, kVA	55

Table 4.6 The contract demand of the college is

Based on the contract demand the fixed charges are levied and the facility is levied the maximum demand recorded in any of the time zone or 75% of the contract demand whichever is higher (called Billing Demand) as the fixed charges. If the facility exceeds the contract demand, for the excess demand, there is a penalty as the excess demand charges.

Here if the demand is below 75% that is 32kVA, the fixed charge will be:

32kVA x 280 = ₹ 8960 / Month

For Hostel - the connected load is 20.866kW ≈ 21kW and the fixed charge is ₹ 80/kW which is 21 x 115 = ₹ 2415.

The energy charges are based on the energy consumption of the facility.

The energy charges is ₹ 7.25 /kWh.

4.4.3 Specific Energy Performance Index

The Energy Performance Index (EPI) is a metric that measures how much energy a building uses per square meter of its built-up area. It is calculated by dividing a building's annual energy consumption by its total built-up area.

SPECIFIC ENERGY CONSUMPTION DURING THE YEAR 2025					
No	Description of Fuel / Production	Unit	Consumption	Conversion Factor	Total (kWh)
A	Electricity	kWh	23,875	1	23,875
B	High Speed Diesel	Ltr	510	3.5	1785
C	Liquified Petroleum Gas – Propane	Kg	87	13	1,131
	Total				26,791
D	Average Number of Students/Year			Nos	520
E	Specific Energy Consumption (kWh /Students/Yr)				51.52

Table 4.7 Energy consumption during the year 2025

ENERGY PERFORMANCE INDEX DURING THE YEAR 2025					
No	Description of Fuel / Production	Unit	Consumption	Conversion Factor	Total (kWh)
A	Electricity	kWh	23,875	1	23,875
B	High Speed Diesel	Ltr	510	3.5	1785
C	Liquified Petroleum Gas – Propane	Kg	87	13	1,131
	Total				26,791
D	Approximate Built-up Area	m^2			3,251
E	Energy Performance Index (kWh /m^2/Yr)				8.24

Table 4.8 Energy performance index during the year 2025

4.4.4 Measured Electrical Parameters

4.4.4.1 Power Quality Analysis –Transformer (9.00 to 13.00 Hrs)

Parameter	Minimum	Average	Maximum
Voltage Line to Neutral		Volts, V	
V1	218.52 - 241.87	223.77 - 242.71	225.58 - 243.57
V2	223.72 - 243.37	226.02 - 244.08	227.75 - 244.85
V3	233.6 - 250.25	235.25 - 251.03	236.94 - 251.78
V N – G	0.81 - 5.9	0.94 - 7.08	1.03 - 9.17
Voltage Line to Line		Volts, V	
U12	394.49 - 422.73	395.8 - 424.08	396.79 - 425.03
U23	397.69 - 426.74	399.88 - 427.91	400.99 - 428.82
U31	390.98 - 423.94	394.5 - 424.89	396.91 - 426.37
Current		Amperes, A	
A1	14 - 34	14 - 35	15 - 39
A2	24 - 41	25 - 43	25 - 52
A3	7 - 23	8 - 23	8 - 28
AN	11 - 23	13 - 26	14 - 31
Power Factor			
PF1	0.92 - 0.97	0.94 - 0.97	0.94 - 0.98
PF2	0.78 - 0.93	0.79 - 0.93	0.8 - 0.95
PF3	0.61 - 0.95	0.88 - 0.95	0.89 - 0.96
PFT	0.71 - 0.92	0.78 - 0.93	0.8 - 0.94
Active Power		Kilowatts, kW	
P1	3 - 7.3	3.1 - 7.6	3.2 - 8.1
P2	4.6 - 8.6	4.7 - 8.9	4.9 - 10.7
P3	1.5 - 5.1	1.6 - 5.3	1.7 - 6.1
PT	9.6 - 19.5	9.9 - 19.8	10.2 - 22.5
Apparent Power		Kilovolt-Ampere, kVA	
S1	3.2 - 7.5	3.3 - 7.8	3.4 - 8.6
S2	5.8 - 9.3	5.9 - 9.6	6.1 - 11.7
S3	1.7 - 5.4	1.8 - 5.5	1.9 - 6.7
ST	12 - 21.3	12.6 - 21.6	12.9 - 25.5
Reactive Power		Kilovolt-Ampere Reactive, kVAR	
Q1	-0.2 - 0.6	-0.1 - 0.6	-0.1 - 1.4
Q2	1.1 - 2.7	1.6 - 2.9	1.8 - 4.1
Q3	-0.4 - 0	-0.4 - 0.1	-0.4 - 1
QT	1.2 - 3	1.5 - 3.3	1.5 - 6
Harmonics		Percentage %	
THD V1	1.68 - 2.59	1.79 - 3.14	1.91 - 4.23

THD V2	1.72 - 2.48	1.83 - 2.64	1.95 - 2.96
THD V3	1.51 - 2.4	1.61 - 2.66	1.68 - 2.87
THD A1	2.29 - 8.75	3.18 - 9.45	3.71 - 13.47
THD A2	15.35 - 34.6	20.28 - 35.48	21.68 - 37.37
THD A3	4.53 - 17.74	5.19 - 20.86	5.9 - 34.17
Frequency, Hz	49.9 - 50.138	49.917 - 50.146	49.933 - 50.15

Table 4.9 Power quality analysis of the transformer

4.4.4.2 System Voltage

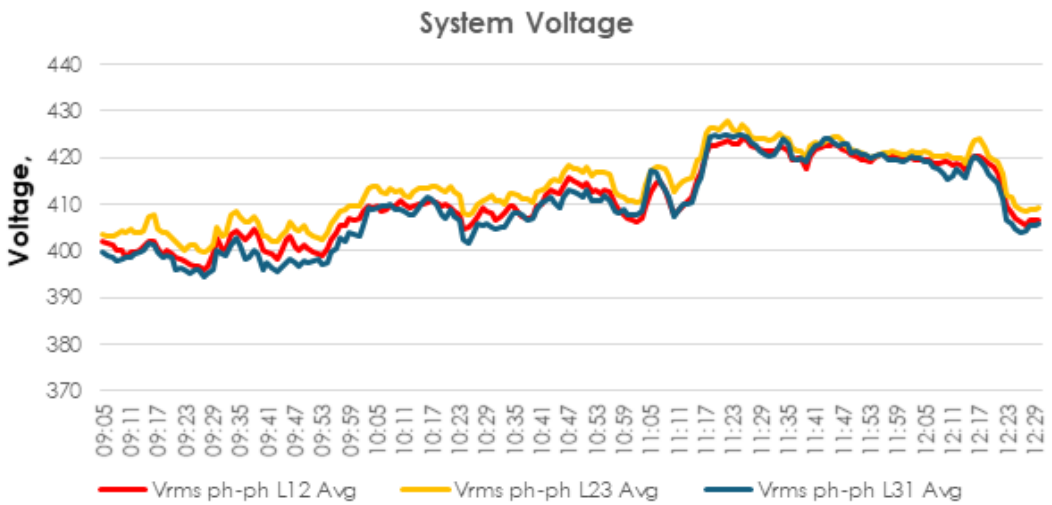


Fig 4.5 Voltage assessment of the college

Voltage Profile

The voltage profile at Martoma Women's College shows elevated levels during peak solar hours from the 30 kWp plant, with line-to-neutral maxima reaching 244-252 V (nominal 240 V) and line-to-line up to 428 V (nominal 415 V), exceeding KSEB's permissible +6% variation (±14 V L-N, ±25 V L-L). Neutral-to-ground voltages up to 9 V indicate minor imbalance, but no PF penalty applies under LT VI A tariff for educational institutions. This overvoltage risks equipment damage, solar inverter trips, and grid stability issues are common in Kerala rooftop solar setups.

Key Inferences

Solar injection causes reverse power flow and voltage rise on the LT feeder, worsened by no on-site transformer for step-down regulation and lengthy rural lines typical in Perumbavoor. Average readings (e.g., V1 224-243 V) straddle limits, confirming time-of-day correlation rather than constant supply fault. Imbalance (V3 highest) suggests uneven solar/load distribution or feeder issues.

Insights

Without APFC, low PF from inductive loads (fans, lights, computers) amplifies voltage issues indirectly via poor current profile, though no penalty exists.

4.4.4.3 Load Current

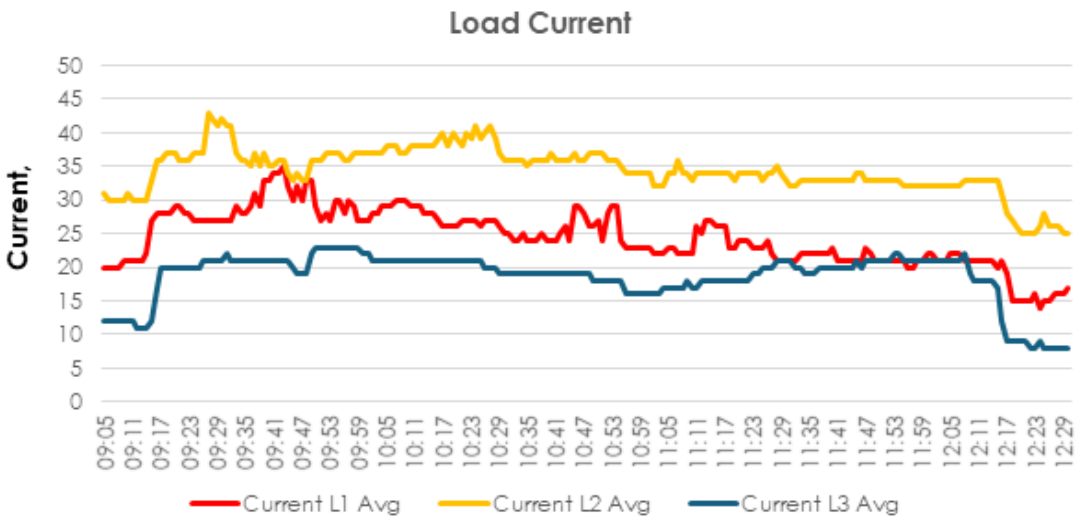


Fig 4.6 Load current assessment of the college

The current profile reveals significant phase imbalance, with A2 maxima up to 52 A contrasting A3 at 28 A, and neutral current (AN) reaching 31 A—indicating substantial zero-sequence components from unbalanced loads or harmonics. This correlates with prior voltage data, where solar injection during low-load periods exacerbates unbalance on the LT supply.

Imbalance Analysis

Current unbalance exceeds IEC guidelines (≤2-5% recommended for motors), risking overheating in connected equipment like motors and pumps at the college. Neutral current ~60-70% of max phase A2 signals triplen harmonics from non-linear loads (LEDs, computers, solar inverters). Voltage imbalance from previous data (~2-3%) likely stems from this current asymmetry per $\Delta V \approx Z \cdot I_{unbal}$, where line impedance amplifies rise on lighter-loaded phases

Insights

Low overall currents (<60 A max, implying <40 kVA load) confirm light college usage during solar peaks, causing reverse flow and imbalance without own transformer for balancing. Harmonics from solar/loads may worsen neutral overload, tying into earlier voltage elevation.

4.4.4.4 Power Factor

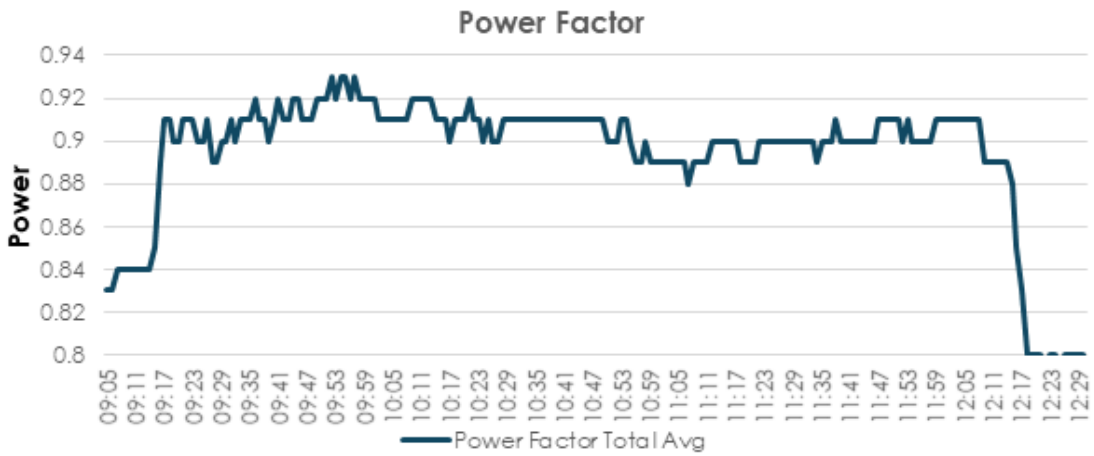


Fig 4.7 The total Power Factor of the facility

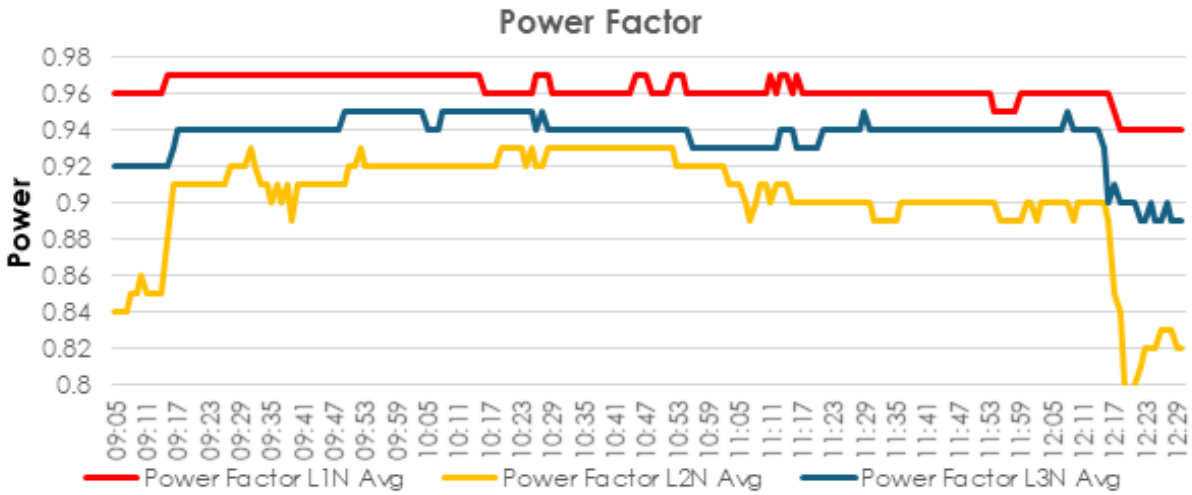


Fig 4.8 The individual phase wise Power Factor

Power factor (PF) readings show per-phase variability, with PF3 dipping to 0.61 minimum—reflecting heavy inductive/unbalanced loads on that phase—while total PF (PFT) ranges 0.71-0.94, averaging 0.78-0.93. Despite no penalty under KSEB LT VI A tariff for educational institutions, low PF ties into prior current imbalance (A3 low) and elevated voltages, amplifying reactive power flow and system losses. Correcting this enhances efficiency, especially with solar integration.

PF Imbalance Causes

Inductive loads like fans, fluorescent/LED drivers, and computers dominate, worsened by uneven distribution (PF2 0.78 min, PF3 lowest). Solar inverters contribute leading vars during peaks, clashing with lagging loads for net poor PFT. Neutral currents from earlier data confirm harmonic-induced reactive issues without filters.

Insights

Low PF increases line currents ($I = P / (V * PF)$), explaining high A2 currents and voltage drops/rises; losses rise ~20-30% below 0.9 PF via higher I^2R. No penalty saves costs now, but future tariff revisions or HT shift could apply 0.90 threshold penalties (e.g., +15% charge below). Solar boosts active power but exposes reactive deficits without correction.

Recommendations

Prioritize APFC panel (20-30 kVAr, auto-switched, detuned for harmonics) targeting PFT >0.98, yielding 10-15% bill savings via reduced kVA demand despite no penalty. Balance loads across phases and audit for inefficient inductive loads if any.

4.4.4.5 Demand

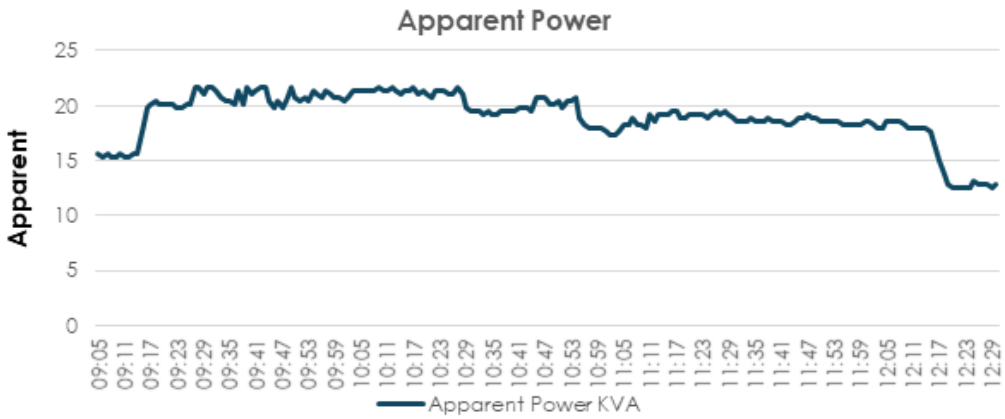


Fig 4.9 The apparent power demand

Power data confirms low daytime load (PT max 22.5 kW, ST 25.5 kVA) during solar peaks from the 30 kWp plant, with net import after self-consumption explaining reduced grid draw—billing demand stays below minimum 32 kVA (75% of 42 kVA contract demand). Phase imbalance persists (P3 low, Q2 high lagging), driving high reactive QT up to 6 kVAr and tying into poor PF3 (0.61 min). Solar export (negative Q on P1/P3) provides some leading vars but insufficient against lagging Q2.

Load Insights

Actual max demand ~25.5 kVA <32 kVA minimum, so KSEB bills fixed demand charge on 32 kVA monthly—no risk of exceeding contract 42 kVA. Reactive dominates on phase 2 (S2/P2 ratio up to ~1.3, poor PF), from unbalanced inductives; total PF aligns with prior data (ST/PT ~1.13 avg). Solar offsets ~70-80% load (22.5 kW vs. 30 kWp potential), ideal for net metering but highlights underutilization without storage.

Billing Status

Under LT VI A, billing demand = max(recorded MD, 75% CD =31.5 kVA ≈32 kVA min); current ST max 25.5 kVA incurs minimum demand charge—no penalty or excess. Net metering credits solar export against import, minimizing energy charges; fixed costs unchanged. Opportunity: Low demand suggests potential CD reduction to cut fixed charges (review annually).

Recommendations

Install 25-30 kVAr APFC panel (detuned) to slash QT by 70-80%, boost PF to 0.98, and lower effective ST—possible future-proof against tariff changes despite exemption. Balance loads (shift to P3) and add solar battery (10-20 kWh) for evening peaks, maximizing self-use. Request KSEB CD downgrade to 30 kVA if sustained <25 kVA, saving ~25% demand fees; conduct annual audit.

4.4.5 System Harmonic Analysis

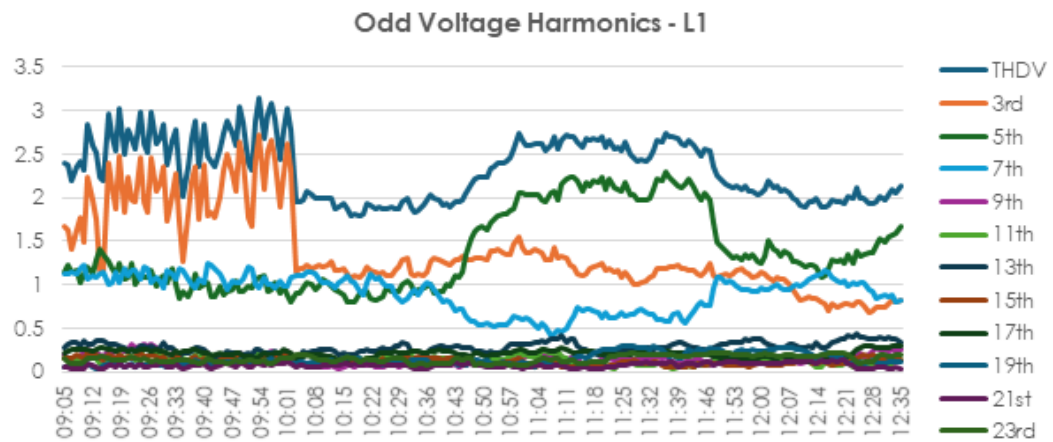


Fig 4.10 System harmonic- old voltage -L1

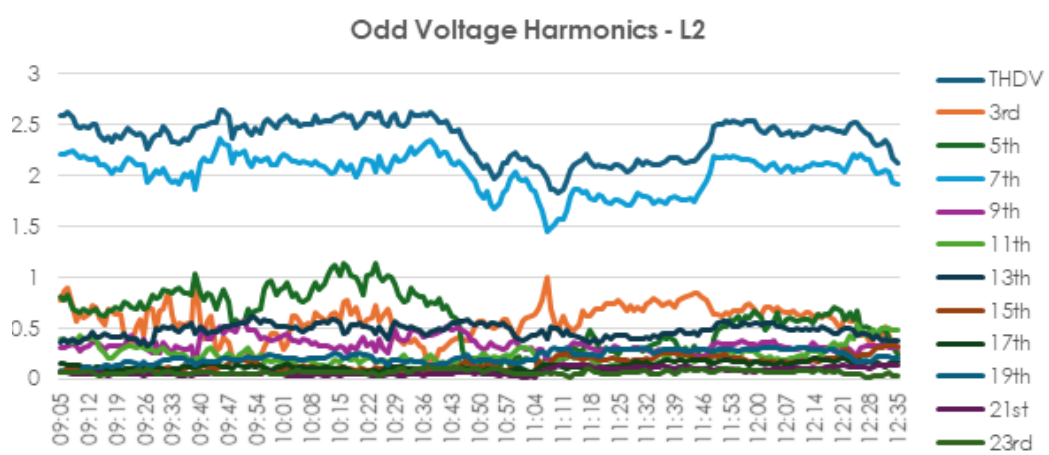


Fig 4.11 System harmonic- old voltage -L2

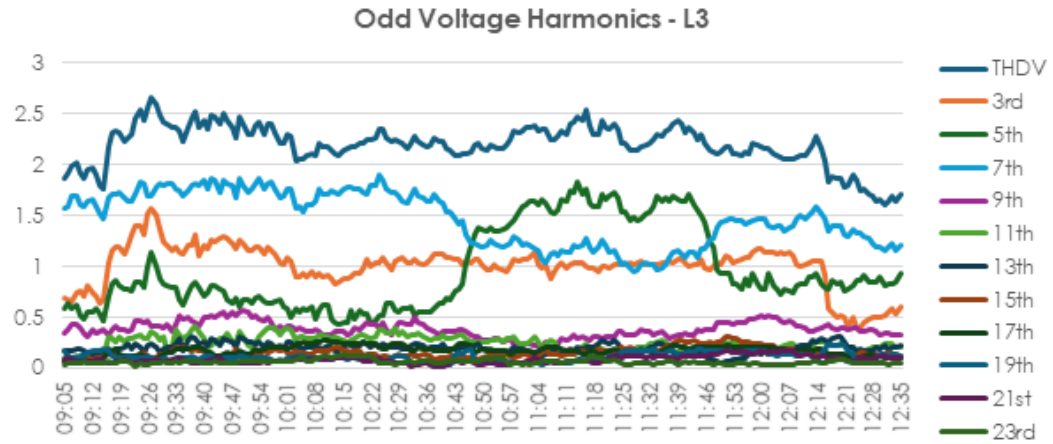


Fig 4.12 System harmonic- old voltage -L3

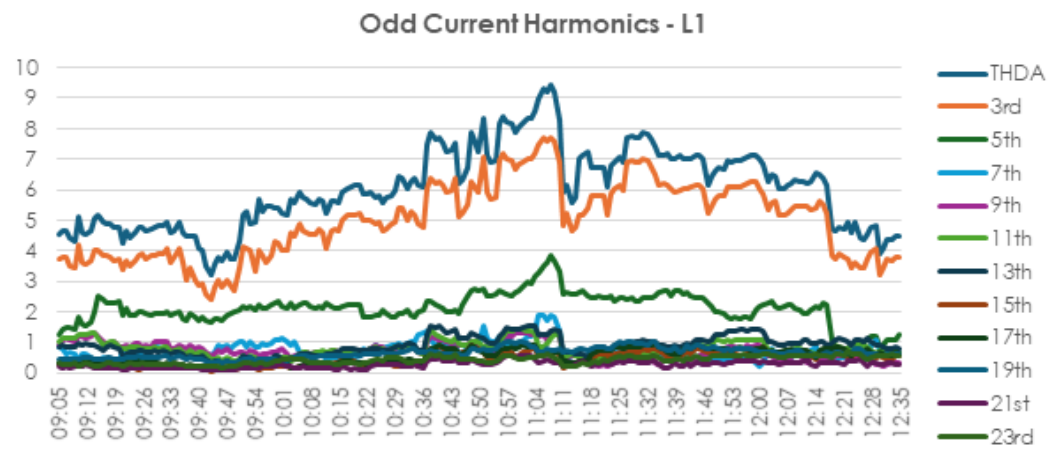


Fig 4.13 System harmonic- old voltage -L1

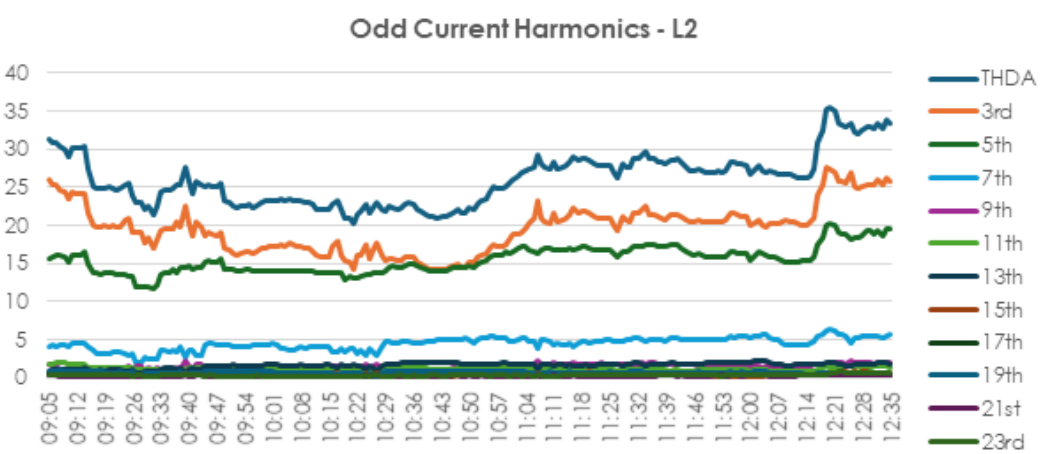


Fig 4.14 System harmonic- old voltage -L2

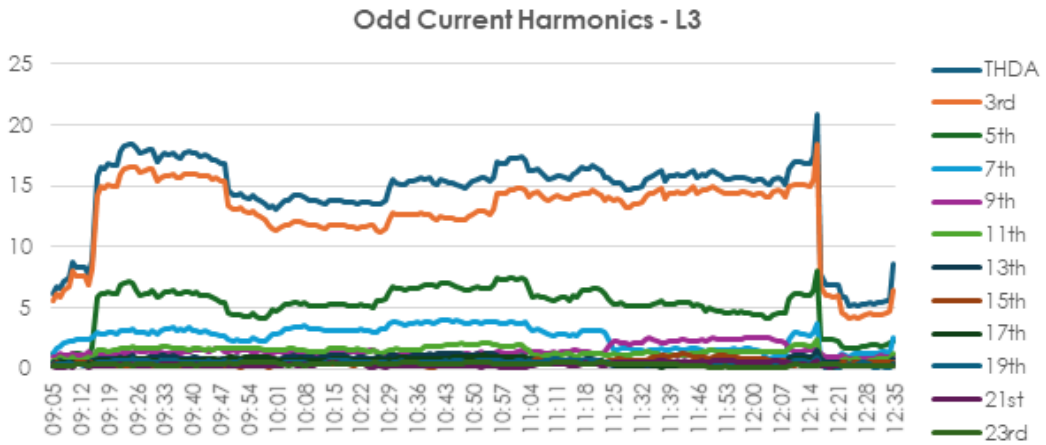


Fig 4.15 System harmonic- old voltage -L3

Harmonics	V1	V2	V3	VN	A1	A2	A3	AN
THD	2.32	2.37	2.19	39.57	6.04	26.03	14.38	36.05
TDD					3.29	19.52	5.88	
3rd	1.38	0.57	1.00	28.91	4.99	19.59	12.67	22.84
5th	1.38	0.59	0.96	19.43	2.11	15.47	5.16	23.58
7th	0.90	2.02	1.46	12.66	0.72	4.49	2.60	8.64
9th	0.15	0.34	0.38	4.64	0.73	1.44	1.50	4.63
11th	0.13	0.24	0.25	3.02	0.80	1.20	1.42	3.06
13th	0.28	0.47	0.19	4.73	0.90	1.62	0.73	3.59
15th	0.12	0.15	0.15	2.55	0.46	0.07	0.25	0.10
17th	0.21	0.13	0.17	1.73	0.53	0.36	0.60	1.04
19th	0.14	0.21	0.11	2.45	0.65	0.68	0.50	1.52
21st	0.08	0.07	0.08	1.40	0.27	0.22	0.34	0.73
23rd	0.15	0.06	0.06	1.03	0.42	0.33	0.35	1.01

Table 4.10 Harmonic limit analysis

The latest CEA regulations on harmonics are defined under the Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2023 and reaffirmed through enforcement circulars issued in 2024–2025. These updates emphasize strict compliance with IEEE 519 2014 harmonic limits for all renewable, hybrid, and large industrial consumers, with mandatory harmonic filter deployment across India.

- Harmonics are governed by Regulation 23 (Voltage and Current Harmonics) of the CEA (Technical Standards for Connectivity to the Grid) Regulations, originally issued in 2013 and amended through 2018 and 2023 notifications.
- The 2023 amendment, fully enforceable from March 2025, aligns Indian grid codes directly with IEEE 519 2014 standards. There is no much variation in the new amended IEEE 519:2022 from 2014 standard.

Limits of Harmonics as per IEEE 519 :2022,

According to IEEE Std 519 2022 — "Recommended Practice and Requirements for Harmonic Control in Electrical Power Systems", the acceptable levels of voltage and current harmonic distortion are defined at the Point of Common Coupling (PCC), where the utility supply meets the user's system.

Bus voltage V at PCC	Individual harmonic (%)	Total harmonic distortion THD (%)
V≤1.0 kV≥	5.0	8.0
1 kV<V≤66 kV	3.0	5.0
69 kV<V≤161 kV	1.5	2.5
161 kV<V	1.0	1.5a

Table 4.11 Voltage harmonic distortion limit

Current Harmonic Distortion Limits (for 120 V – 69 kV Systems)
For the ratio ISC/IL (short circuit current at PCC / maximum demand load current):

Maximum harmonic current distortion in percent I_L Individual harmonic order (odd harmonics) ①②						
I_{sc}/I_L	3≤h≤11	11≤h≤17	17≤h≤23	23≤h≤35	35≤h≤50	TDD
<20 ③	4.0	2.0	1.5	0.6	0.3	5.0
20<50	7.0	3.5	2.5	1.0	0.5	8.0
50<100	10.0	4.5	4.0	1.5	0.7	12.0
100<1000	12.0	5.5	5.0	2.0	1.0	15.0
>1000	15.0	7.0	6.0	2.5	1.4	20.0

Table 4.12 Percentage of harmonic current distortion

Harmonic analysis reveals low voltage THD (2.2-2.4%, well under IEEE 519-2022 <5-8% for <1 kV) but severe issues in neutral (VN THD 39.57%, AN 36.05%) and currents (A2 THD 26.03%, TDD 19.52%). Triplen harmonics (3rd/9th ~20-29% in neutral) dominate, confirming unbalanced non-linear loads (computers, LEDs, solar inverters) causing zero-sequence currents that overload neutral conductor. This aligns with prior neutral current (31 A max) and PF dips.

Harmonic Issues

Current TDD exceeds IEEE 519 limits for weak grids; phase A2 worst, likely heaviest non-linear load. Voltage clean due to solar inverter compliance or low overall distortion propagation. High neutral THD risks overheating, transformer neutral damage, and relay maloperation—common in solar-equipped LT sites without mitigation

Insights

Solar inverters and unbalanced single-phase loads (e.g., IT equipment in college) generate odd triplens, summing in neutral (3x phase value), explaining AN THD/TDD. Low power (~20 kW) masks severity, but risks equipment life (motors derate 20-30% at high THD).

4.4.6 Thermographic Assessment

Thermal images are an easy way to identify apparent temperature differences in industrial three-phase electrical circuits, compared to their normal operating conditions.

By inspecting the thermal gradients of all three phases side-by-side, can quickly spot performance anomalies on individual legs due to unbalance or overloading.

Equal load should equate to equal temperatures. In an unbalanced load situation, the more heavily loaded phase(s) will appear warmer than others due to the heat generated by resistance. However, an unbalanced load, an overload, a bad connection, and a harmonic imbalance can all create a similar pattern. Measuring the electrical load is required to diagnose the problem.

The measured temperature with respect to the ambient temperature is compared to detect the abnormal heating of components.

Temperature Rise above Ambient	Severity	Recommended Action
1^{0}C to 10^{0}C	**Normal**	**No Action Required**
11^{0}C to 20^{0}C	**Minor**	**Monitor, analyse load condition, schedule for repairs.**
21^{0}C to 40^{0}C	**High**	**Repair in one or two days, reduce load until repairs are complete.**
Over 40^{0}C	**Critical**	**Repair immediately, reduce or control load till repairs are complete.**

Table 4.13 Thermal imaging temperature level

4.4.6.1 Thermal Images

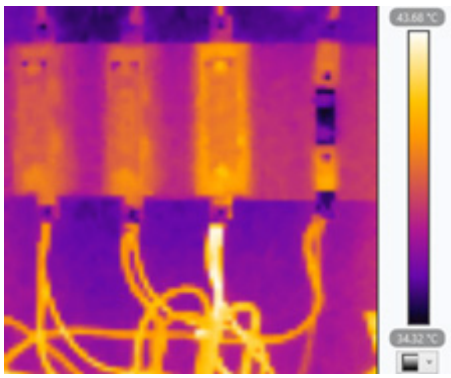
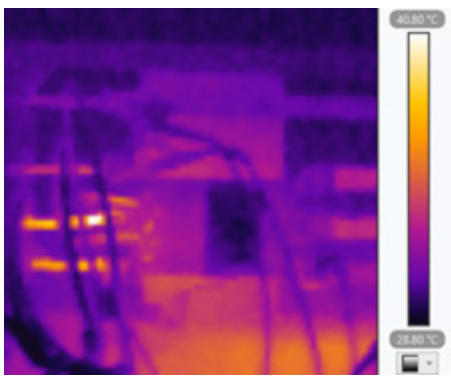
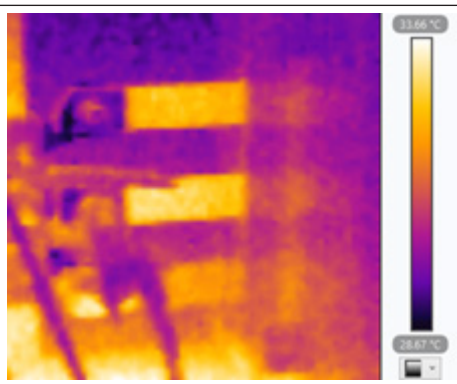
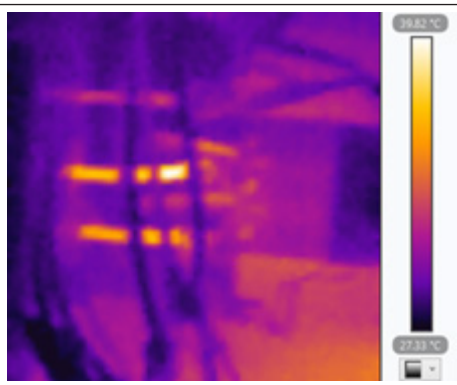
No	DESCRIPTION	Thermal Image	Temperature, ^{0}C
		SB3	
1	Feeder		43.68
2	Feeder		40.80
3	Feeder		33.66
4	Feeder		39.82

Table 4.14 The thermal assessment conducted panel wise is detailed be

Summary of Thermography

No	DESCRIPTION	Temperature, ^{0}C	Criticality
1	Feeder	43.68	Minor
2	Feeder	40.80	Minor
3	Feeder	33.62	Normal
4	Feeder	39.82	Normal

Table 4.15 Summary analysis of thermography

4.4.7 Infrastructure assessment and overview

Sl.No	Location Name	No of points	Operating hours (hr per week)	Watt	Count	kWh	Kwh per year
1	I DC BA	Tube light	40	40	2	1.6	166.4
		Incandescent bulb	12	100	1	1.2	62.4
2	Classroom 201	Tube light	40	40	6	1.6	499.2
		Fan	40	60	6	2.4	748.8
		LED Tube	40	20	4	0.8	166.4
3	Classroom 202	LED Tube	40	20	1	0.8	41.6
		Tube light	40	40	1	1.6	83.2
		Fan	40	60	1	2.4	124.8
		Mic	40	100	1	4	208
4	Office	Computer	40	12	7	0.48	174.72
		Fan	40	60	7	2.4	873.6
		Celin light	40	9	1	0.36	18.72
5	Office side room	Tube light	40	40	2	1.6	166.4
		CCTV	40	100	1	4	208
		Fan	40	60	2	2.4	249.6
6	Principle	AC	40	52753	2	2110	219452.48
		Fan	40	60	2	2.4	249.6
		CCTV	40	100	1	4	208
		TV	40	12	1	0.48	24.96
		Computer	40	12	1	0.48	24.96
7	Principal side room	CCTV	40	100	1	4	208
		LED Tube	40	9	1	0.36	18.72
		Tube light	40	40	1	1.6	83.2
		Celin light	40	9	2	0.36	37.44
8	Classroom 213	Tube light	40	40	2	1.6	166.4
		Fan	40	60	2	2.4	249.6
9	Classroom 221	Fan	40	60	4	2.4	499.2

		Tube light	40	20	2	0.8	83.2
		CCTV	40	100	1	4	208
10	Classroom 219	Fan	40	60	4	2.4	499.2
		Tube light	40	20	2	0.8	83.2
		CCTV	40	100	1	4	208
11	Classroom 217	Fan	40	60	3	2.4	374.4
		Tube light	40	20	2	0.8	83.2
		CCTV	40	100	1	4	208
12	Classroom 216	Fan	40	60	2	2.4	249.6
		LED Tube	40	20	2	0.8	83.2
		CCTV	40	100	1	4	208
13	Board room	AC	40	5000	2	200	20800
		LED (BIG)	40	9	4	0.36	74.88
		LED (small)	40	7	9	0.28	131.04
		TV	40	17	1	0.68	35.36
14	Bathroom	Tube light	40	20	2	0.8	83.2
		Computer lab	40	60	12	2.4	1497.6
15	Computer lab (way in)	Fan	40	60	2	2.4	249.6
		Tube light	40	40	1	1.6	83.2
16	Classroom 205	Fan	40	60	1	2.4	124.8
		Printer	40	10	1	0.4	20.8
		Tube light	40	40	1	1.6	83.2
		Mic	40	100	1	4	208
		Fan	40	60	4	2.4	499.2
		Projector	40	100	1	4	208
		Tube light	40	40	6	1.6	499.2
17	Classroom 206	Mic	40	100	1	4	208
		Fan	40	60	2	2.4	249.6
		Bulb	40	20	1	0.8	41.6
		Tube light	40	40	1	1.6	83.2
		Computer	40	12	1	0.48	24.96
18	Classroom 209	Tube light	40	40	2	1.6	166.4
		Fan	40	60	2	2.4	249.6
		CCTV	40	100	1	4	208
19	Museum	Tube light	40	40	2	1.6	166.4
20	Classroom 207	Tube light	40	40	4	1.6	332.8
		Fan	40	60	2	2.4	249.6
		CCTV	40	100	1	4	208

21	Classroom 301	Fan	40	60	6	2.4	748.8
		Tube light	40	40	3	1.6	249.6
		Bulb	40	9	1	0.36	18.72
		CCTV	40	100	1	4	208
22	Classroom 302	Fan	40	60	2	2.4	249.6
		Tube light	40	40	2	1.6	166.4
23	Classroom 303	Fan	40	60	2	2.4	249.6
		Tube light	40	40	1	1.6	83.2
		Projector	40	100	1	4	208
24	Classroom 305	Fan	40	60	2	2.4	249.6
		Tube light	40	40	1	1.6	83.2
		Mic	40	100	1	4	208
		CCTV	40	100	1	4	208
25	Classroom 306	Fan	40	60	2	2.4	249.6
		CCTV	40	100	1	4	208
		Tube light	40	40	2	1.6	166.4
		Projector	40	100	1	4	208
26	Classroom 307	Fan	40	60	2	2.4	249.6
		Tube light	40	40	1	1.6	83.2
27	Classroom 308	Fan	40	60	1	2.4	124.8
		Tube light	40	40	1	1.6	83.2
28	Classroom 309	Fan	40	60	1	2.4	124.8
		Mic	40	100	1	4	208
		Tube light	40	40	1	1.6	83.2
		Projector	40	100	1	4	208
29	Classroom 310	Fan	40	60	2	2.4	249.6
		Tube light	40	40	2	1.6	166.4
		Mic	40	100	1	4	208
30	Classroom 311	Fan	40	60	2	2.4	249.6
		Tube light	40	40	3	1.6	249.6
		Mic	40	100	1	4	208
31	Classroom 312	Fan	40	60	2	2.4	249.6
		Tube light	40	40	3	1.6	249.6
		Projector	40	100	1	4	208
		Mic	40	100	1	4	208
32	Classroom 313	Fan	40	60	2	2.4	249.6
		Tube light	40	40	1	1.6	83.2
		Mic	40	100	1	4	208
33	Classroom 314	Fan	40	60	2	2.4	249.6
		Tube light	40	40	3	1.6	249.6

		Mic	40	100	1	4	208
34	Classroom 315	Fan	40	60	7	2.4	873.6
		LED Bulb	40	20	16	0.8	665.6
		Strip light	40	8	1	0.32	16.64
35	Classroom 316	Fan	40	60	6	2.4	748.8
		Mic	40	100	1	4	208
		Tube light	40	40	6	1.6	499.2
		Computer	40	120	1	4.8	249.6
36	Chapel	Tube light	40	40	10	1.6	832
		Fan	40	60	10	2.4	1248
37	Bathroom	Tube light	40	40	1	1.6	83.2
		Bulb	40	9	3	0.36	56.16
38	Classroom 321	Fan	40	60	2	2.4	249.6
		Tube light	40	40	2	1.6	166.4
		Projector	40	100	1	4	208
39	Classroom 322	Fan	40	60	2	2.4	249.6
		Tube light	40	40	2	1.6	166.4
40	Classroom 323	Fan	40	60	2	2.4	249.6
		Tube light	40	40	2	1.6	166.4
		Projector	40	100	1	4	208
41	Classroom 324	CCTV	40	100	1	4	208
		Tube light	40	40	1	1.6	83.2
		Fan	40	60	6	2.4	748.8
42	MSc Lab 2	Tube light	40	40	2	1.6	166.4
		Fan	40	60	2	2.4	249.6
43	Watchman room	Fan	40	60	1	2.4	124.8
		Tube light	40	40	1	1.6	83.2
44	Pumping room	Motor	7.5	3.75	1	0.03	1.4625
45	Sick room	LED Bulb	8	9	7	0.07	26.208
		Fan	2	60	2	0.12	12.48
46	Washroom	LED	2	9	9	0.02	8.424
		CFL	14	20	2	0.28	29.12
47	Gym	LED	18	9	11	0.16	92.664
		CFL	14	20	2	0.28	29.12
48	Canteen	Filament bulb		7	7	0	0
		LED	8	9	8	0.07	29.952
		LED Tube	20	25	7	0.5	182
		Fan	40	60	9	2.4	1123.2
49	Auditorium	Fan	40	60	51	2.4	6364.8
		Speaker	30	1100	4	33	6864

		Floor late GCM		150	3	0	0
		LED Tube	20	20	89	0.4	1851.2
		LED	8	100	7	0.8	291.2
		DMX-38H Intelligent lighting controlled	240	10	1	2.4	124.8
		Yamaha MG 16 x mixing console	30	30	1	0.9	46.8
		Sennheiser EM - XSWI	12	3.6	1	0.04	2.2464
							288232.64

Table 4.16 Electrical infrastructure of the campus

Fig 4.16 electric infrastructure mapping of classroom

Sl No	Location Name	Equipment	Count	Watt	Hours (Monthly)	Days	kWh	kWh Per year
1	Zoology Lab	Electric oven	1	1000	1.5	45	1.5	67.5
2		Incubator	1	1000	35	60	35	2100
3		Refrigerator	1	750	24	30	18	540
4		Centrifuge	1	4.45	4.2	10	0.01869	0.1869
								2707.69

Table 4.17 Electrical infrastructure of Zoology lab

Fig 4.17 electric infrastructure mapping of lab

Sl No		No of points	Operating hours (hr per week)	Watt	Count	kWh	kWh Per year
1	Kitchen (H)	Fan	40	60	2	2.4	249.6
		Tube light	40	40	3	1.6	249.6
		LED	40	9	4	0.36	74.88
2	Dining Hall	Fan	40	60	2	2.4	249.6
		Tube light	40	40	3	1.6	249.6
		LED	40	9	1	0.36	18.72
3	Living area	Fan	40	60	3	2.4	374.4
		LED	40	9	7	0.36	131.04
4	106 Bedroom	Fan	40	60	2	2.4	249.6
		Tub light	40	40	1	1.6	83.2

		LED	40	9	2	0.36	37.44
5	105 Bedroom	Fan	40	60	2	2.4	249.6
		LED	40	9	3	0.36	56.16
		Tube light	40	40	3	1.6	249.6
6	Bathroom	LED	40	9	1	0.36	18.72
7	104 Bedroom	Fan	40	60	2	2.4	249.6
		LED	40	9	3	0.36	56.16
8	Study room 103	Fan	40	60	2	2.4	249.6
		LED	40	9	3	0.36	56.16
		Tube light	40	40	2	1.6	166.4
9	102 Bedroom	Fan	40	60	2	2.4	249.6
		LED	40	9	3	0.36	56.16
10	Study room 101	Fan	40	60	2	2.4	249.6
		LED	40	9	4	0.36	74.88
11	Outside room	LED	40	9	2	0.36	37.44
12	107 Bedroom	Fan	40	60	2	2.4	249.6
		LED	40	9	3	0.36	56.16
13	108 Bedroom	Fan	40	60	2	2.4	249.6
		LED	40	9	4	0.36	74.88
14	109 Bedroom	Fan	40	60	2	2.4	249.6
		LED	40	9	2	0.36	37.44
15	110 Bedroom	Fan	40	60	2	2.4	249.6
		LED	40	9	2	0.36	37.44
16	Bathroom	LED	40	9	9	0.36	168.48
17	111 Bedroom	Fan	40	60	2	2.4	249.6
		LEDS	40	9	2	0.36	37.44
18	102 Bedrooms	LED	40	9	9	0.36	168.48
		Fan	40	60	2	2.4	249.6
		LEDS	40	9	2	0.36	37.44
19	113 Bedroom	LED	40	9	9	0.36	168.48
		Fan	40	60	2	2.4	249.6
		LEDS	40	9	2	0.36	37.44
20	114 Bedroom	LED	40	9	9	0.36	168.48
		Fan	40	60	2	2.4	249.6
		LEDS	40	9	2	0.36	37.44
21	Outside room	LED	40	9	2	0.36	37.44
22	201, 202 Study room	Fan	40	60	4	2.4	499.2
		LED	40	9	4	0.36	74.88
23	203 Bedroom	Fan	40	60	2	2.4	249.6

		LED	40	9	3	0.36	56.16
24	204 Bedroom	Fan	40	60	2	2.4	249.6
		LED	40	9	4	0.36	74.88
		firmament bulb	40	7	1	0.28	14.56
25	Bathroom	filament bulb	40	7	2	0.28	29.12
26	205 Bedroom	Fan	40	60	2	2.4	249.6
		LED	40	9	3	0.36	56.16
27	206 Bedroom	Fan	40	60	2	2.4	249.6
		LED	40	9	4	0.36	74.88
28	Prayer room	LED	40	9	1	0.36	18.72
29	Outside	filament bulb	40	7	3	0.28	43.68
30	207 Bedroom	Fan	40	60	2	2.4	249.6
		LED	40	9	3	0.36	56.16
31	208 Bedroom	Fan	40	60	2	2.4	249.6
		LED	40	9	3	0.36	56.16
32	209 Bedroom	Fan	40	40	2	1.6	166.4
33	210 Bedroom	Fan	40	9	5	0.36	93.6
		Tube light	40	60	2	2.4	249.6
34	Bathroom	LED	40	9	4	0.36	74.88
35	211 Bedroom	Fan	40	60	2	2.4	249.6
36	212 Bedroom	Fan	40	60	2	2.4	249.6
37	2013 Bedroom	Fan	40	60	2	2.4	249.6
		Tube light	40	40	4	1.6	332.8
38	214 Bedroom	Fan	40	60	1	2.4	124.8
		LED	40	9	2	0.36	37.44
39	215 Bedroom	LED	40	9	3	0.36	56.16
40	Outside	LED	40	9	1	0.36	18.72
		Tube light	40	40	2	1.6	166.4
41	Kitchen	Fridge	24	300	1	7.2	374.4
42		Grinder	21	500	1	10.5	546
43		Exhaust	7	30	1	0.21	10.92
44		Iron box	14	500	1	7	364
		Mixer grinder	1	500	1	0.5	26
46		Filament	40	40	1	1.6	83.2
							13077.48

Table 4.18 Electrical infrastructure of hostel

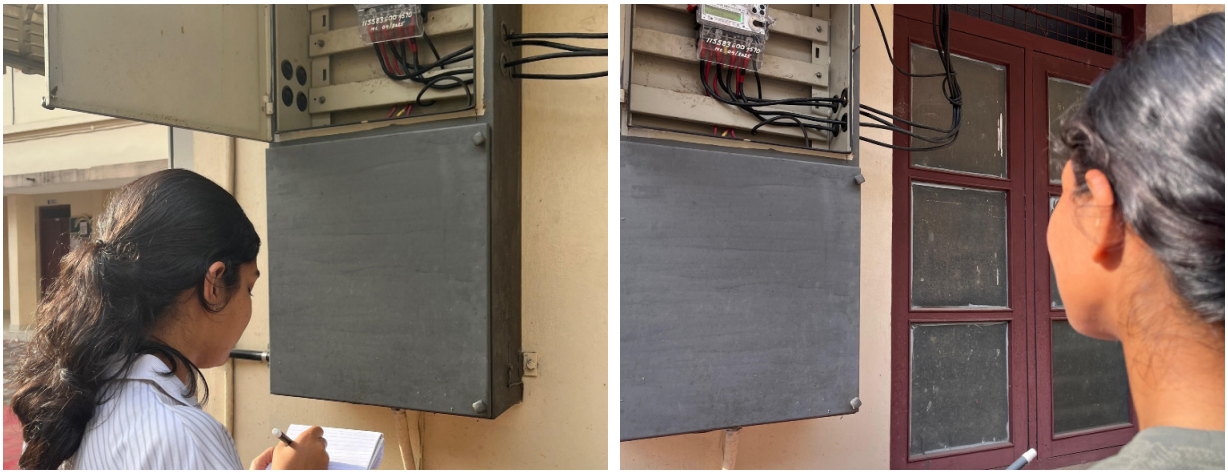


Fig 4.18 Sampling of KSEB Electric Meter Reading

Fig 4.19 EnMS Internal Audit Review & Progress Meeting

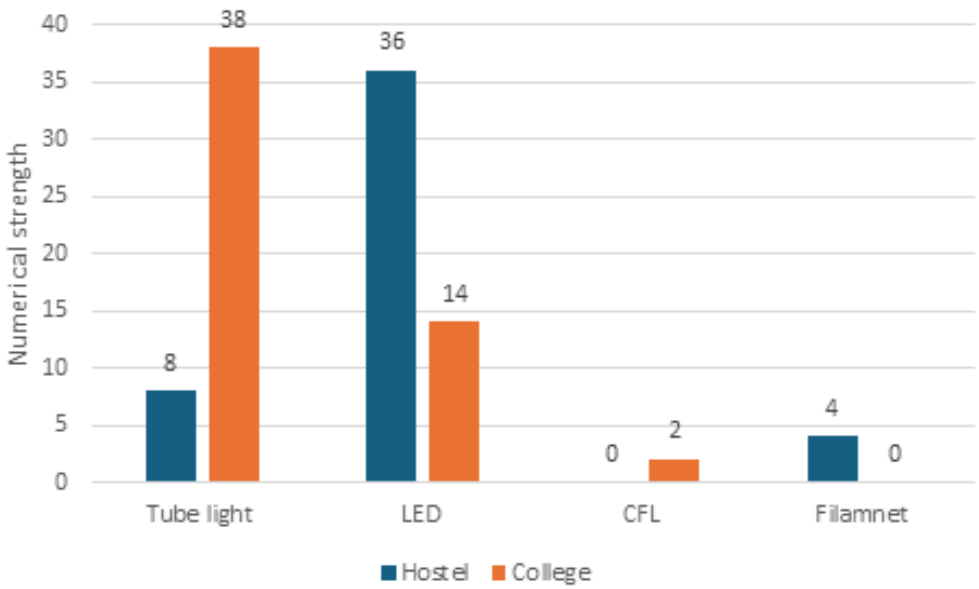


Fig 4.20 Number of light fixature by type

The energy assessment reveals that the annual electricity consumption in the college campus is significantly higher than in the hostel, primarily driven by differences in occupancy, usage patterns, and load profiles. With an average strength of 520 in the college compared to only 57 in the hostel, the campus experiences substantially greater demand for lighting, fans, computers, projectors, laboratory equipment, and other appliances throughout extended operational hours and diverse activities. The inventory indicates approximately 38 conventional tube lights, 2 CFLs, and 14 LEDs in the college, alongside numerous fans (over 100 units across entries), computers, projectors, mics, speakers, and high-power items like air conditioners, contributing to elevated baseline and peak loads. In contrast, the hostel relies more on efficient lighting, with around 36 LEDs, 8 normal lights, and

4 filament bulbs, resulting in lower overall consumption due to limited occupancy, shorter usage durations, and fewer energy-intensive devices. While equipment efficiency plays a role such as the shift toward LEDs in both areas the dominant factors remain the college's larger population and varied functional requirements (e.g., classrooms, labs, and audiovisual systems), leading to proportionally higher energy use per facility. This aligns with typical patterns in Kerala educational institutions, where campus-wide activities often result in greater per-student or per-area consumption compared to residential hostels, though both benefit from ongoing transitions to energy-efficient fixtures to mitigate differences.

4.4.8 Electricity bill assessment analysis of the year 2022, 2023 & 24

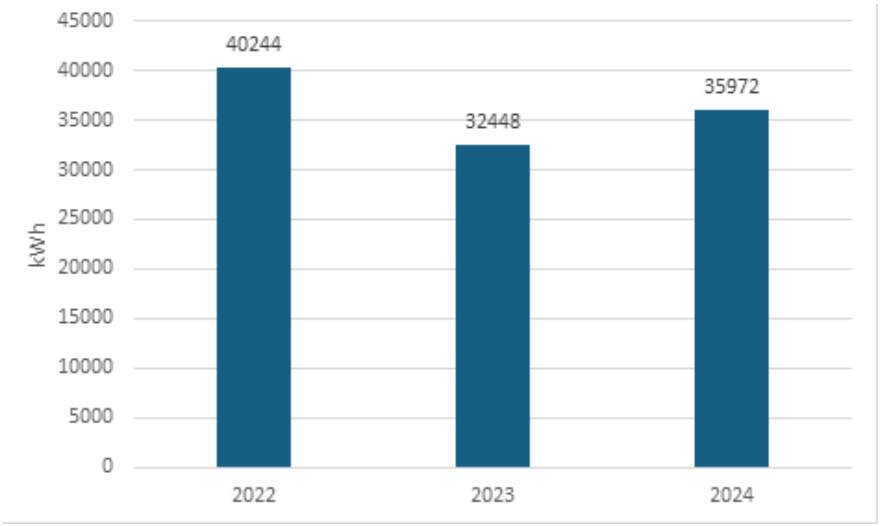


Fig 4.21 Annual Unit of consumption -1155836004590

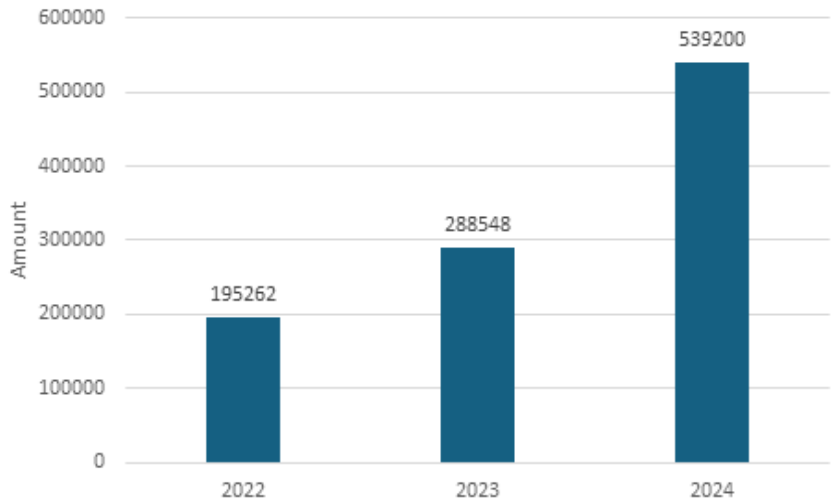


Fig 4.22 Annual Utility amount of 1155836004590

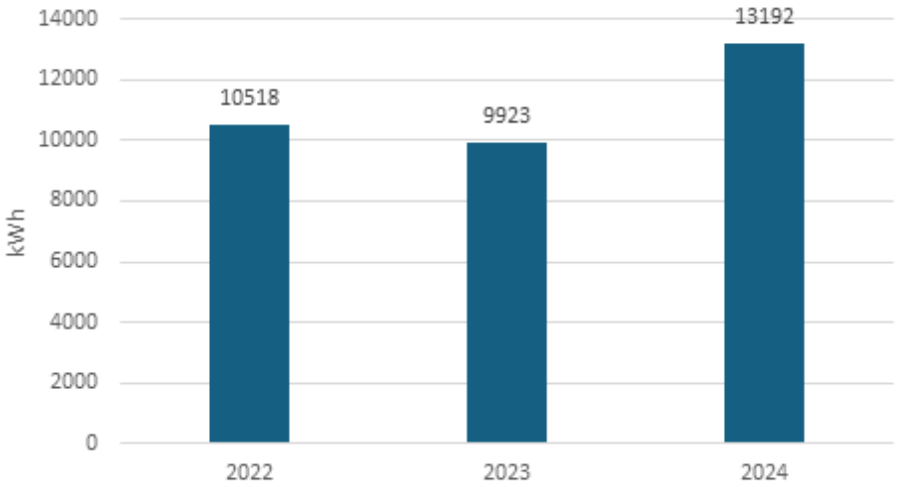


Fig 4.23 Annual unit of consumption -1155834021297

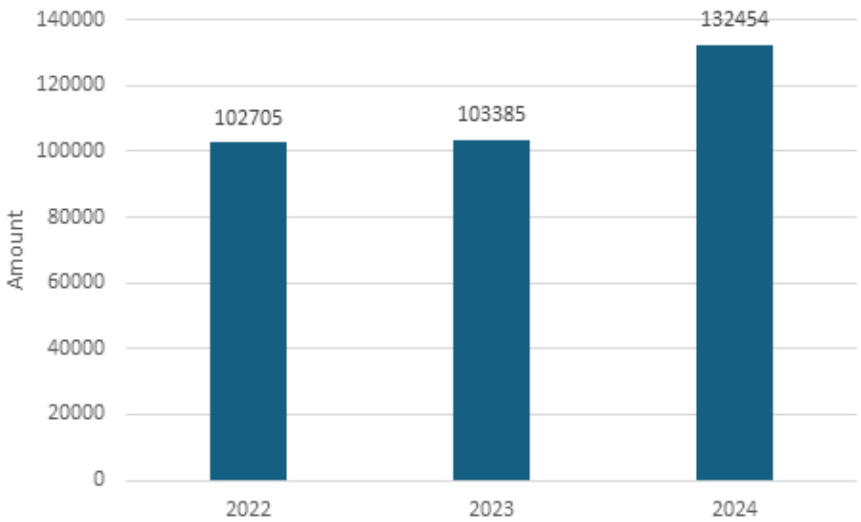


Fig 4.24 Annual Utility amount of 1155834021297

Fig 4.25 College main auditorium

The average annual energy consumption of the hostel is 11,211 kWh, while that of the college (main campus/ buildings) is 36,221.33 kWh. A noticeable variation in energy consumption demand occurred during the audit period. In 2023, consumption was observed to be lower compared to 2022. This reduction can be attributed primarily to the operational 35 kVA off-grid solar system installed at the college, which generated renewable energy during that year and thereby offset a portion of the grid dependency. However, due to maintenance issues with the solar system, energy production declined subsequently, leading to increased reliance on the KSEB (Kerala State Electricity Board) grid connection. The analysis also highlights that outdated equipment and inadequate energy conservation practices (due to careless management) contribute to suboptimal energy efficiency across the facilities.

Variations in both the energy bill and consumption can be attributed to several key factors:

Actual Usage Decline: Energy consumption may be less than anticipated due to the adoption of energy-efficient appliances, intentional reductions in usage, or the implementation of new energy-saving practices.

Meter Alteration: Evidence of tampering with the meter could indicate that the recorded readings are artificially inflated.

Enhanced Appliance Usage: Rising consumption levels may result from the introduction of new electrical devices, prolonged usage of existing appliances, or the use of less energy-efficient models.

Tariff Changes: Fluctuations in electricity pricing can lead to increased total bills, even when energy consumption remains unchanged.

Defective Appliances: Malfunctioning appliances may consume significantly more energy than their standard operational capacity.

Inefficient Building Structure: Poor insulation, inadequate ventilation, and significant air leaks can result in higher energy consumption to maintain comfortable heating and cooling temperatures. These factors collectively highlight the complexities surrounding energy consumption and billing at the college.

4.4.9 KSEB meter reading sampling analysis

Sampling days	Average annual consumption
Working day	7200.00
Semi holiday	2565.00
Holiday	1890.00
	11655.00

Table 4.19 KSEB meter analysis of the college

Sampling days	Average annual consumption
Working day	5733.33
Semi holiday	316.67
Holiday	233.33
	6283.33

Table 4.20 KSEB meter analysis of the hostel

Fig 4.26 Sample KSEB Electric Meter Reading

Assessment of electricity meter readings indicates that energy consumption is notably higher among college strength users, driven by elevated demand levels and differences in equipment operational efficiency.

4.4.10 Total energy consumption of Mar Thoma College

No.	Assessment Mode	Total energy Consumption/year (kWh)	
		College	Hostel
1	Infrastructure assessment	290940.33	13077.48
2	Mandatory Audit	3396	1611
3	KSEB Bill analysis	36,221.33	11,211
4	Energy Meter Reading Sample Study	11655.00	6283.33
5	Annual solar Production	Not applicable	Not applicable

Table 4.21 Summary of electrical energy consumption

4.4.11 LPG Usage

Sl No	Department	Number of cylinders per month	Capacity
1	Chemistry Lab	4	14.2
2	Zoology Lab	2	14.2
3	Botany Lab	0	0
4	Physics Lab	2	14.2
5	Canteen	2	14.2
6	Hostel	4	14.2
	Total	14	71

Table 4.22 Annual LPG consumption

The college has procured a total of 14 LPG cylinders, corresponding to an estimated annual consumption of approximately 71 kg of LPG.

Implementing biomass energy solutions offers a significant opportunity to substantially reduce reliance on LPG purchases, achieve cost savings, lower greenhouse gas emissions, and potentially qualify for carbon credits. Additionally, upgrading or repairing the existing biogas plant from its current capacity of 2 m^3 (or 2,000 liters) to double that capacity would further enhance on-site renewable energy generation and support long-term sustainability goals. This dual approach (biomass adoption combined with biogas plant enhancement) positions the institution to achieve meaningful environmental and financial benefits.

4.4.12 Fuel Usage

Sl No	Date	Volume of fuel purchased in Litres
1	05-04-2023	Diesel worth Rs. 2000 = 20.6L approx.
2	02-05-2023	Diesel worth Rs. 2000 = 20.6L approx.
3	04-05-2023	Diesel worth Rs. 2000 = 20.6L approx.
4	05-05-2023	Diesel worth Rs. 2000 = 20.6L approx.
5	25-05-2023	Diesel worth Rs. 2000 = 20.6L approx.
6	19-06-2023	Diesel worth Rs. 2000 = 20.6L approx.
7	13-07-2023	Diesel worth Rs. 2000 = 20.6L approx.
8	27-07-2023	Diesel worth Rs. 2000 = 20.6L approx.
9	17-08-2023	Diesel worth Rs. 2000 = 20.6L approx.
10	18-09-2023	Diesel worth Rs. 2000 = 20.6L approx.
11	21-09-2023	Diesel worth Rs. 2000 = 20.6L approx.
12	30-09-2023	Diesel worth Rs. 2000 = 20.6L approx.
13	09-10-2023	Diesel worth Rs. 2000 = 20.6L approx.
14	12-10-2023	Diesel worth Rs. 2000 = 20.6L approx.
15	26-10-2023	Diesel worth Rs. 2000 = 20.6L approx.
16	31-10-2023	Diesel worth Rs. 2000 = 24L approx.
17	17-11-2023	Diesel worth Rs. 2000 = 20.6L approx.
18	13-12-2023	Diesel worth Rs. 2000 = 20.6L approx.
19	08-01-2024	Diesel worth Rs. 2000 = 20.6L approx.
20	24-01-2024	Diesel worth Rs. 2000 = 20.6L approx.
21	01-02-2024	Diesel worth Rs. 2000 = 20.6L approx.
22	23-02-2024	Diesel worth Rs. 2000 = 20.6L approx.

Table 4.23 Annual Fuel consumption 2023-24

Sl No	Date	Volume of fuel purchased in Litres
1	15-04-2024	Diesel worth Rs. 2000 = 20.9L approx.
2	20-04-2024	Diesel worth Rs. 2000 = 20.9L approx.
3	23-04-2024	Diesel worth Rs. 2000 = 20.9L approx.
4	30-4-2024	Diesel worth Rs. 2000 = 20.9L approx.
5	20-06-2024	Diesel worth Rs. 2000 = 20.9L approx.
6	25-06-2024	Diesel worth Rs. 2000 = 20.9L approx.
7	01-07-2024	Diesel worth Rs. 2000 = 20.9L approx.
8	02-07-2024	Diesel worth Rs. 2000 = 20.9L approx.
9	06-07-2024	Diesel worth Rs. 4000 = 41.8L approx.
10	12-7-2024	Diesel worth Rs. 2000 = 20.9L approx.
11	26-7-2024	Diesel worth Rs. 2000 = 20.9L approx.
12	30-7-2024	Diesel worth Rs. 2000 = 20.9L approx.
13	24-8-2024	Diesel worth Rs. 2000 = 20.9L approx.
14	1-10-2024	Diesel worth Rs. 2000 = 20.9L approx.
15	21-10-2024	Diesel worth Rs. 2000 = 20.9L approx.
16	18-11-2024	Diesel worth Rs. 2000 = 20.9L approx.
17	21-11-2024	Diesel worth Rs. 2000 = 20.9L approx.
18	22-11-2024	Diesel worth Rs. 2000 = 20.9L approx.
19	22-1-2025	Diesel worth Rs. 2000 = 20.9L approx.
20	3-2-2025	Diesel worth Rs. 2000 = 20.9L approx.
21	10-3-2025	Diesel worth Rs. 2000 = 20.9L approx.
22	24-3-2025	Diesel worth Rs. 2000 = 20.9L approx.
23	25-3-2025	Diesel worth Rs. 2000 = 20.9L approx.

Table 4.24 Annual Fuel consumption 2024-25

The annual diesel fuel requirement for operating the 30-kW generator stood at 453.2 litres in the financial year 2023-24, increasing to 480.7 litres in the financial year 2024-25

Fig 4.27 College Diesel Generator Unit

4.4.13 Vehicle Sharing Status

Sl No	Two-Wheeler	Average distance covered (from-to)	Sharing Status (Yes/No)
1	1	9	No
2	1	4	Yes
3	1	6	No
4	1	2	No
5	1	4	No
6	1	100	No
7	1	40	No
14	1	4	No
15	1	10	Yes
16	1	5	No
17	1	2	No
20	1	25	No
21	1	15	No
27	1	25	No
28	1	75	Yes
30	1	24	No
31	1	10	No

33	1	8	No
34	1	2	No
35	1	6	No
36	1	5	No
39	1	20	No
40	1	14	No
41	1	15	No
42	1	16	No
43	1	1	No
44	1	8	No
45	1	2	No
46	1	3	No
47	1	2	No
48	1	18	No
49	1	14	No
50	1	10	No
51	1	18	No
	34	901.5	

Table 4.25 Two-wheeler strength and sharing status

Fig 4.28 Vehicle parking photo can be attached here

Sl No	Four-Wheeler	Average distance covered (from-to)	Sharing Status (Yes/No)
11	1	8	No
12	1	12	Yes
13	1	2	No
19	1	30	No
22	1	130	No
23	1	20	No
24	1	8	No
26	1	13	No
29	1	20	Yes
37	1	3	No
38	1	5	No
	11	901.5	

Table 4.26 Four -wheeler strength and sharing status

A total of 11 four-wheelers, including 2 shared vehicles, have resulted in a fuel savings of 120200 liters. Additionally, there are 34 two-wheelers, of which 3 are shared, leading to an annual fuel saving of 7212 liters

4.5 CONCLUSION

- The audit of Mar Thoma Women's for College (including hostel) under KSEB LT-6A/6B tariffs for 2025 reveals generally low energy consumption (total ~26,791 kWh equivalent, EPI 8.24 kWh/m^2/year, specific consumption 51.52 kWh/student/year) with a 30 kWp solar plant offsetting much of daytime load, resulting in low grid demand and no excess demand penalties. However, key issues include overvoltage during solar peak hours, driven by reverse power flow on rural LT lines without on-site regulation. Significant phase imbalance persists, causing uneven loading and potential equipment stress. Power factor is low increasing losses despite no penalty for educational institutions under current KSEB tariffs. Harmonics show low voltage. Severe current/neutral distortion (A2 THD 26%, neutral THD 39.57%, triplens dominant from non-linear loads like LEDs/computers/solar inverters), risking neutral overheating and reduced equipment life. Thermography indicates minor hotspots on feeders. Diesel (510 L) and LPG (87 kg) contribute minor supplementary energy. Recommendations focus on installing detuned APFC (20–30 kVAr) for PF >0.98, load balancing, harmonic filters, potential contract demand reduction, and solar battery addition to enhance efficiency and mitigate grid impacts.
- The college's electricity consumption remains notably higher than optimal levels, primarily due to the continued reliance on conventional tube lights and CFLs, with only a limited adoption of energy-efficient LEDs. Although the institution operates a solar plant, no significant net export of power is currently occurring, indicating scope for better optimisation of solar generation and self-consumption. Furthermore, there is evident potential to promote vehicle-sharing practices among students and staff, even on a modest scale, as a means to reduce individual vehicular trips, lower associated fuel consumption, and contribute to overall energy conservation. These observations underscore the institution's pressing need to prioritise comprehensive energy conservation measures, including accelerated transition to LED lighting, enhanced solar utilisation strategies, and awareness initiatives for sustainable commuting, to achieve meaningful reductions in energy use and environmental impact.

4.6 RECOMMENDATIONS

- Install a Detuned Automatic Power Factor Correction (APFC) Panel: Recommend a 25–30 kVAr auto-switched APFC panel equipped with a 7% detuning reactor (tuned to approximately 189 Hz) to achieve a target power factor exceeding 0.98. This measure

will substantially reduce reactive power demand (currently up to 6 kVAr), enhance voltage stability, minimise I^2R losses in the distribution system, and deliver estimated energy cost savings of 10–15% through reduced apparent power demand and improved overall efficiency. Detuned APFC systems are particularly effective and widely adopted in Indian educational institutions with rooftop solar integration, as they protect capacitor banks from harmonic distortion generated by non-linear loads and solar inverters.

- Optimise and Expand Solar Utilisation: Immediately repair any damaged components of the existing 30 kWp rooftop solar plant and consider phased capacity enhancement where feasible. To address peak evening demand (6–10 PM) and maximise self-consumption beyond the current 70–80% level, install 10–20 kWh of battery energy storage system (BESS). This will store excess daytime generation for later use, reduce grid dependency during high-tariff periods, improve net metering benefits, and align with emerging Kerala regulatory trends toward mandatory storage for larger rooftop systems, thereby enhancing long-term energy security and financial returns.
- Strengthen Electrical Safety and Maintenance Practices: Appoint a qualified, licensed electrician or electrical maintenance team to oversee routine inspections and upkeep. Address identified safety concerns in the main electrical panel room by conducting annual comprehensive panel maintenance checks. Ensure availability and proper placement of essential safety equipment, including insulated safety gloves, fire extinguishers suitable for electrical fires, and high-dielectric rubber mats. Additionally, install Residual Current Circuit Breakers (RCCBs) on vertical distribution boards (DBs) to provide reliable fault current detection and protection against electric shocks and fire hazards.
- Transition to Energy-Efficient Lighting and Fans: Systematically replace all existing tube lights and CFLs with modern, high-efficacy LED luminaires across the campus (college and hostel). Complement this by upgrading conventional ceiling fans to energy-efficient Brushless DC (BLDC) models, which consume 50–70% less power while delivering comparable or superior airflow. This upgrade aligns with Kerala state energy conservation initiatives (e.g., those promoted by the Energy Management Centre) and can yield significant long-term reductions in electricity consumption and bills.
- Promote Energy Conservation Awareness: Develop and prominently display educational signage throughout the campus in classrooms, corridors, hostels, and common areas, highlighting simple energy-saving habits such as switching off lights and fans when not in use, optimising AC/equipment settings, and avoiding standby power wastage. These visual reminders will foster a culture of responsible energy use among students, faculty, and staff.
- Encourage Sustainable Commuting Practices: Actively promote vehicle-sharing (carpooling) among students, faculty, and staff to reduce individual vehicle trips, lower fuel consumption, mitigate traffic congestion, and decrease associated emissions. Organise campus-wide initiatives such as carpool matching drives, awareness competitions, reward programs for consistent participants (e.g., certificates, recognition events, or small incentives

4.7 ENERGY MANAGEMENT PLAN

4.7.1 Establish and Adopt an Energy Management Team

The Energy Management Team integrates a variety of expertise and viewpoints. This team consist of faculty, facility and maintenance staff with practical experience in building operations, student representatives to bring fresh ideas and campus feedback, as well as external advisors like energy consultants or local utility experts for specialised advice. Clearly define specific roles for team members, such as an audit lead responsible for conducting energy assessments, a data analyst to track consumption data and spot trends, and a survey coordinator to collect input from the wider campus community. Furthermore, specify the team's main responsibilities, including developing energy-saving strategies, monitoring progress, and proposing policy modifications; set a regular meeting schedule (for example, bi-weekly or monthly) to maintain ongoing collaboration; and establish a clear reporting process to relay findings and recommendations to senior administration for approval and execution.

4.7.2 Formulate a Comprehensive Strategy for Sustainable Energy Management

The energy audit process commences by clearly outlining its primary goals, which include assessing performance, achieving full compliance with Bureau of Energy Efficiency (BEE) regulations, and promoting the SDG 7 objectives for affordable and clean energy through targeted efficiency improvements. This approach aligns with both state and national energy policies, as well as the institution's overall sustainability goals, creating a unified framework for long-term environmental stewardship. Significant infrastructure improvements involve systematically replacing conventional lighting and appliances with energy-efficient LED systems and five-star-rated products, leading to substantial reductions in energy consumption and operating costs. Additionally, academic integration is emphasised by incorporating energy efficiency concepts into the curriculum through dedicated research projects, student internships, specialised short courses, and collaborations with external organisations, thus fostering a culture of innovation and practical knowledge in sustainable energy management.

4.7.3 Implement Effective Methods to Attain Set Objectives

Improve energy efficiency by creating and employing specialised audit tools, including checklists, data loggers, and precise meters for systematic information collection. Gather baseline data on energy consumption to establish a clear reference for current usage patterns. Conduct comprehensive internal audits using methods such as walkthroughs, detailed inspections, and identify inefficiencies and potential problems with the support of external auditors. Finally, provide practical recommendations, which may include installing LED bulbs, implementing sensor-based automation systems, and integrating solar panels to achieve significant reductions in energy consumption and costs.

4.7.4 Establish Robust Communication Channels

The organisation will implement regular reporting mechanisms, such as monthly and quarterly progress updates, to monitor advancements. Organise workshops and seminars to inform stakeholders about important initiatives. A governing body, like a Sustainability Committee, will be formed to supervise implementation and ensure adherence to standards. Transparency will be upheld through documented meeting minutes, while internal and external communications will be facilitated through official departmental WhatsApp groups and emails.

4.7.5 Set Both Long-Term and Short-Term Goals

4.7.5.1 Short-Term Goals (0–1 Year):

- Partner with the Bureau of Energy Standards to perform a thorough energy audit of the entire campus.
- Display informative signage to effectively communicate and promote energy-saving practices.
- Equip electrical rooms with proper safety gear, including labelled areas, insulated matting, gloves, and accessible fire extinguishers.
- Shift to 80% LED lighting across campus to enhance energy efficiency by 2027
- Promote a culture of sustainability by increasing awareness and encouraging active participation among students and staff in energy conservation practices through strategically placed display boards and informative signage.

4.7.5.2 Long-Term Goals (1–5 Years):

- Aim for a 20–30% reduction in campus energy consumption. Focus on compliance with the Bureau of Energy Standards, implement solar energy solutions, and promote vehicle-sharing practices.
- Enhance energy efficiency by replacing existing equipment with star-rated and Brushless Direct Current (BLDC) fans.
- Designate a permanent electrician to oversee and manage campus electrical systems effectively.
- Expand the solar energy system to enhance renewable energy generation.
- Support initiatives in research and student projects

aimed at developing sustainable and affordable energy conservation solutions.

- Establish the institution as a model for green campus initiatives and sustainable practices in the education sector.

4.7.6 Continuously Monitor and Enhance the System

Enhance energy efficiency by implementing an Energy Management Information System (EMIS) whenever feasible, as it enables real-time monitoring and data analysis to better utilise resources through record-keeping and documentation. Furthermore, conduct regular mini audits to evaluate performance metrics against set baseline data, which helps in the early detection of any inconsistencies. Continuously assess the effectiveness of all implemented measures using data and modify action plans as needed to promote ongoing improvement and achieve sustained savings.

4.7.7 Conclude and Conduct Follow-Up on the System

Maintain long-term sustainability and consistently improve energy management practices. Internal auditors release an annual energy report that clearly details performance metrics, accomplishments, and potential areas for enhancement. Systematically record lessons learned and best practices to enhance institutional knowledge, plan re-audits every 2 to 3 years or as required by significant changes, and promote ongoing improvement by actively engaging stakeholder feedback and integrating new technologies.

4.8 ACTIVITIES CONDUCTED

Activity Report 2023-24- Energy Audit

Energy Conservation Day Celebration

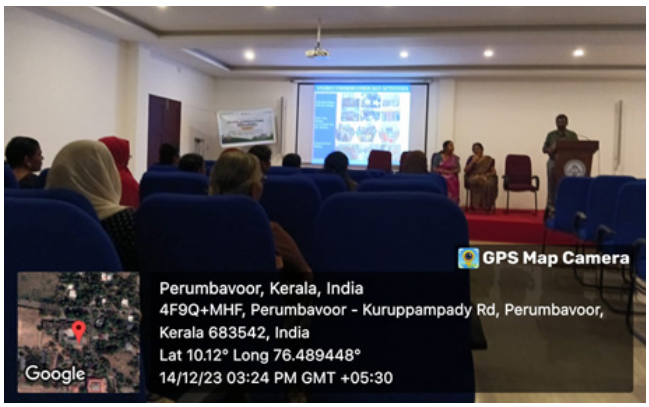
The Department of Physics organized a Workshop on Energy Efficient Devices, on 14 December 2023 as part of Energy Conservation Day celebration. Mr. M P Mani, Secretary, Energy Conservation Society, Perumbavoor Chapter, served as the resource person.

Orientation for Mothers on Energy Conservation

On 14 December 2023, Mr. M P Mani, Secretary, Energy Conservation Society, Perumbavoor Chapter, took a class on 'Energy Conservation', for mothers of our students.

LED Making

The students of the Department of Physics under the leadership of faculties of the department made LED stars and sold them during the months of November and December, with the profits going towards a good cause



Dr. Anupama P, Assistant Professor, Department of Physics elected as Vice President, Energy Conservation Society, Ernakulam Chapter.

Syamini Sasi (III B.Sc. Physics) and Sandra P S (II B.Sc. Physics) attended Intercollegiate Energy Quiz Competition 2023, organized by Energy Conservation Society, on 29 September 2023.

Ms. Manjari D Bhattathiri (II IP Physics) and Ms. Gouri Krishnakumar (I B.Sc. Physics)

secured 1 st and 2 nd prize in the power quiz conducted by Kerala State Electricity Board (KSEB).

Activity Report 2024-25- Energy Audit

A star /decorative items making workshop was held from 11- 20 December 2024 as every year. The students under the leadership of faculties of the department made **Neon**

decorative items and LED stars for the X'Mas season and sold. LED bulbs are energy saving bulbs

The funds from Decorative items were donated to **Santhwanam Special School, Kothamangalam** during a visit on January 24th, 2024. This is an excellent example of how science and technology can be used for a noble cause. By contributing to this cause, the Department of Physics has shown that they care about the welfare of the special

children and are willing to take concrete steps to support them.

The Department celebrated National Energy Conservation Day on 16 December 2024. A workshop on energy saving LED bulbs, stars etc was arranged for students of Luke Memorial Public School.

The Department of Physics conducted a **Power Quiz** in association with KSEB Officers Association on 26 September 2024. Students from different departments participated in it. Ms. Aruna Sasi (II B.Sc. Physics) and Ms. Anna M. R. (III

IP Physics) secured 1st and 2nd prize in the college level competition and participated in the district level competition held at UC College Aluva, on 6 November 2025.

An **Industrial visit** was arranged for the students during 3 October 2024 to the Nuclear Power Plant, Kudankulam, Tamil Nadu. Scientists of KKNPP took a class on nuclear reactions and career opportunities there.

Chapter V

WATER EFFICIENCY MANAGEMENT SYSTEM (We MS): AUDIT REPORT

TIES

MAR THOMA COLLEGE FOR WOMEN PERUMBAVOOR

THE TRUTH SHALL MAKE YOU FREE

WATER EFFECIENCY MANAGEMENT SYSTEM (WEMS 2025-26)

Sherin T Abraham
Dr Anu Joy
Dr. Melvi Chandy
Dr Rinu Elizabeth Philip
Chaithanya Elsa Achankunju
Dr Shalitha Jacob
Assistant Professors
Paul P.M.
Technical staff

Ciann Jilson
Christeena
Ardra Sabu
Alshifa Jaleel
Riya Mary
Aysha Fidha K S
Fathima T A
Aisha Parvin
Aaryambika
Sethulekshmi
Adhila Ameen
Vismaya
Students

5

Water Efficiency Management System : Audit Report

5.1 INTRODUCTION

Water is an essential natural resource crucial for the survival of all living organisms. Both animals and plants rely on water to maintain life, as it plays a fundamental role in their daily metabolic functions. For plants, water is vital for photosynthesis, allowing them to create their own food and support growth. Water resources encompass all natural water bodies on Earth in any form—vapour, liquid, or solid—that can be utilised by humans. The most readily available sources include oceans, rivers, and lakes, while other reserves consist of groundwater, deep subsurface water, glaciers, and permanent snowfields. On average, individuals use about 600 to 700 liters of water daily. While humans can survive several days without food, going without water is unimaginable; similarly, plants will wilt and lose their leaves without it.

India receives an average annual precipitation of 4,000 billion cubic meters (BCM), which is unevenly spread geographically and temporally. Approximately 75% of this rainfall occurs during the four months of the monsoon season, with nearly half falling within just 15 days and under 100 hours. Kerala, recognised for its significant annual rainfall of about 3,000 mm, sees around 60% of this precipitation during the two monsoon periods, while the remaining 40% is from summer rains. However, recent shifts in weather patterns have disrupted this consistent cycle, resulting in more concentrated rainfall and flooding, leading to considerable challenges for the state. ISO standards provide a cohesive framework for technology and terminology, fostering effective cooperation among countries sharing water resources. These standards offer practical solutions and best practices for sustainable water management, addressing areas such as measuring and optimising water use, treating and reusing wastewater, and managing water services and irrigation in sectors like agriculture, manufacturing, and construction. They also serve as a basis for public policies that tackle the effects of climate change, sanitation, and commitments to water management.

ISO environmental management guidelines, including water footprint assessments, assist organisations in evaluating the effects of their water consumption and identifying strategies for improving efficiency and reducing usage. These standards also outline methods for managing and treating sludge and by-products

generated from urban wastewater systems, stormwater, and water treatment plants, thereby encouraging sustainable practices in water and wastewater management.

5.1.1 What is a Water Audit?

A water audit offers a comprehensive assessment of how an entity utilises water, starting from the source of intake to the point of discharge, meticulously evaluating every aspect of its usage. This assessment measures the volume of water consumed, identifies any leaks or waste, and highlights opportunities for reducing usage. Additionally, it reviews existing treatment systems and practices, recommending enhancements to improve efficiency and decrease overall consumption. Based on the findings, the audit provides recommendations to reduce waste and consumption, optimise treatment practices, and conduct cost-benefit analyses. It also suggests implementing a system to monitor water intake, distribution, and utilisation.

The necessary requirements for conducting a water audit include:

- Documentation of the overall volume of water used by the college.
- Detection of water losses along with suggested measures to address them (such as addressing leaks, overflow, and other untracked losses from improper use, etc.).
- A sustainable water conservation plan that encompasses changes in behavior, encourages water reuse, promotes wastewater recycling, and explores alternative water sources.

The water audit entails methodically establishing a water balance by assessing the flow of water from its source or treatment facility, through the distribution system, to different usage locations, and ultimately to its discharge. This process involves calculating the water balance, analysing water consumption, and pinpointing possible opportunities for water conservation.

5.1.2 Need for Water Audit

Water audits act as a means to pinpoint zones with high water consumption, evaluate the effects of pollutants in wastewater, and create strategies for mitigation based on the 3R principles (Reduce, Reuse, and Recycle). Our water audit services have assisted industries in choosing effective approaches to reduce water usage, decrease wastewater generation, and improve resource recovery. These audits offer comprehensive solutions for water efficiency, leading to cost savings while ensuring adherence to internal policies, legal standards, and showcasing a commitment to sustainability.

The objectives of the water audit are to:

- Reduce water losses
- Improve financial performance
- Enhance the reliability of the supply system (providing quality water)
- Optimise the performance of the distribution system
- Strengthen protection for public health and property
- Serve as an effective educational and public relations tool for water
- Minimise legal liabilities, and
- Decrease disruptions, thus improving service levels for the entire college/university community.

The water audits utilise a multi-step strategy to increase awareness among water users, including students, staff, and visitors, to deliver both short-term and long-term sustainable water management solutions. Throughout this process, teams composed of analytical, design, and engineering professionals collaborate to examine the audit findings and create enhanced strategies for water management and sustainability.

Introducing a water efficiency management plan into action can result in considerable savings in water and energy, which helps reduce the environmental impacts linked to water discharge and the need to transport water over long distances.

- The creation and proper implementation of a water efficiency management system are designed to improve water efficiency and can lead to the following outcomes:
- Viewing water as a valuable resource can be incorporated into organisational and financial planning.
- Assisting an organisation in effectively managing its water usage and enhancing water demand efficiency.
- Recognising the possible effects on others that may result from alterations in water consumption.
- Promoting increased accountability for water usage.

- Providing a structure for continuous assessment to pinpoint areas for enhancing water efficiency.
- Achieving cost reductions by decreasing water consumption through sustainable design practices, the implementation of water-saving devices, and efficient monitoring.

5. 2 WATER EFFICIENCY MANAGEMENT POLICY

5.2.1 Statement Of Commitment

Mar Thoma College for Women, Perumbavoor, is committed to environmental sustainability and responsible stewardship of natural resources. Recognizing the critical importance of water as a finite resource, the institution commits to reducing water consumption, managing water resources responsibly, and promoting a culture of water conservation within the campus community. This policy serves as a guiding framework for ensuring water sustainability in institutional operations, infrastructure, and educational activities.

The college is committed to responsible water management through structured audits, conservation, and efficient usage to ensure sustainability. Establish a Water Efficiency Management Committee (WMC) responsible for policy execution, periodic audits, and strategy updates. This ensures accountability and a structured approach to achieving water efficiency goals.

5.2.2 Goal

To conduct a comprehensive water audit within the college, aimed at evaluating current consumption patterns, identifying opportunities for reduction, enhancing conservation practices, promoting awareness among students and staff, and ensuring the sustainable management and protection of institutional water resources.

5.2.3 Objective

- To achieve a 50% reduction in overall water consumption by the year 2026.
- To establish and maintain a structured Water Efficiency Management System (WEMS) to monitor, manage, and optimise usage.
- To foster a campus-wide culture of water conservation through continuous awareness, engagement, and capacity-building initiatives.
- To integrate sustainable water management practices into all operational, infrastructural, and academic activities.
- To implement data-driven planning to ensure the effective monitoring, evaluation, and continual improvement of water usage efficiency.

5.2.4 Resources Management

A. Water Conservation and Management

5.2.4.1 Expansion of Rainwater Harvesting:

Rooftops, sheds, and open structures will be equipped with sloped surfaces and gutters to channel rainwater into underground storage tanks. These tanks will be designed for optimal hygiene and capacity, ensuring water availability during the summer. Upcoming construction will incorporate rainwater harvesting systems, while existing structures will be retrofitted based on the possibility. The harvested rainwater will be stored for non-potable purposes such as gardening and floor cleaning, reducing dependency on municipal supplies. Regular maintenance will be carried out to prevent blockages or contamination. Educational programs will promote awareness and participation in rainwater harvesting. The campus will also expand its harvesting infrastructure to maximize collection and reduce dependence on groundwater.

5.2.4.2 Groundwater Recharge through Percolation Pits:

Recharge pits will be constructed at scientifically identified locations to replenish groundwater levels. These pits, designed with layers of gravel and sand, will facilitate effective filtration before infiltration.

5.2.4.3 Signage and Eco-visual Messaging:

Reminder posters, wall art, and digital signage will be strategically placed in wash areas, corridors, and hostels to encourage daily water-saving practices.

5.2.4.4 Awareness and Training Initiatives:

Regular campaigns, workshops, and seminars will engage students, staff, and community members on water conservation methods such as greywater reuse and leak detection.

B Water Infrastructure Management

5.2.4.5 Sensor-Based Devices and Advanced Fixtures: Installation of motion-sensing taps, automatic shut-off valves, dual-flush toilets, and low-flow fixtures will be prioritised to reduce wastage.

5.2.4.6 Water Flow Monitoring: Flow meters will be installed at main supply points, hostels, washrooms, and laboratories to track consumption and identify irregularities.

5.2.4.7 Capacity Building of Staff: Maintenance and operations teams for water pumping will receive continuous training on advanced water management tools, techniques, and safety protocols to ensure efficient system operation.

C Water Quality Assessment

5.2.4.8 Preventive Maintenance of Water Systems: All rainwater harvesting tanks, underground reservoirs, and distribution systems will undergo periodic cleaning and inspection to maintain hygiene and prevent contamination.

5.2.4.9 Quality Monitoring: Regular water quality testing will be conducted to ensure compliance with institutional and national standards, with data used to guide corrective measures.

D Alternative Energy Management

5.2.4.10 Solar-Powered Water Distribution Systems: Solar pumps will be installed to transport water across departments, hostels, and gardens. This initiative will reduce dependence on grid electricity, lower carbon emissions, and align with the campus's broader sustainability vision.

5.2.3 Curriculum Integration

5.2.3.1 Experiential Learning: Students will participate in practical activities such as water auditing, rainwater harvesting, and greywater recycling, both within the campus and in household settings, facilitating the application of theoretical concepts to real-life situations. The academic curriculum will be strategically upgraded to dedicated modules on water conservation, sustainability, and environmental management across A minimum of five academic programs. Integrating these themes into the formal education system will provide students with both in-depth knowledge and hands-on experience essential for sustainable living. Project-based learning, fieldwork, and internships focusing on water efficiency will be promoted to strengthen the link between academic instruction and real-world practice. This educational strategy aims to develop environmentally conscious graduates capable of promoting and implementing sustainable water management practices in both personal and professional domains.

5.2.3.2 Student-Led Awareness Initiatives: Students will be motivated to design and implement water conservation initiatives both on campus and community, thereby deepening their understanding while actively supporting the college's sustainability objectives. To enhance participation, competitions and incentive-driven programs will be conducted, encouraging collaborative yet healthy competition among students and staff in adopting water-saving practices. These efforts aim to advance a long-term culture of awareness and responsibility toward water usage across the institution.

5.2.4 Green Initiatives

The institution is committed to adopting environmentally responsible practices that complement water conservation and management. These initiatives aim to reduce the overall ecological footprint of campus operations while fostering environmental awareness among the college community.

5.2.4.1 Renewable Energy Integration: Expansion of renewable energy applications like solar-powered water pumping systems to operate water treatment units, pumping stations, and monitoring systems.

5.2.4.2 Rainwater Utilisation and Groundwater Recharge: Maximising rainwater harvesting from all viable rooftop and open surfaces and implementing percolation pits and recharge wells to enhance groundwater levels and promote aquifer sustainability.

5.2.4.3 Sustainable Landscaping and Irrigation: Adoption of drip irrigation systems and moisture sensors in gardens to minimise water wastage. Planting of native and drought-resistant species to reduce irrigation demand and promote biodiversity.

5.2.4.4 Wastewater Recycling and Greywater Reuse: Development of greywater treatment units for reuse in gardening, cleaning, and other non-potable applications. Strict monitoring to ensure treated water meets safety and environmental standards

5.2.4.5 Eco-awareness and Behavioural Change: Incorporating sustainability and water conservation topics into academic curricula and extracurricular activities. Organising green campus campaigns, eco-clubs, and student-led initiatives to promote responsible water and energy use.

5.2.5 Purchasing and Procurement:

The institution is committed to integrating sustainability into all purchasing and procurement activities, with a special focus on water-related products and services. The following principles will guide decision-making:

5.2.6 Promote the purchase of environmentally Friendly Products.

Preference will be given to goods and materials that are water-efficient, biodegradable, recyclable, or made from recycled content.

- Minimise the procurement of single-use plastics and products with high water footprints whenever alternatives are available.
- Evaluate the lifecycle impact of products and services, prioritising those that minimise water consumption, reduce pollution, and support long-term sustainability.
- Incorporate sustainability criteria in vendor selection and sinigang contract agreements.
- Promote the adoption of green certifications (e.g., Water Sense, eco-labels) for products and suppliers.
- Encourage procurement from local suppliers to reduce transportation-related water and energy use, while strengthening the local economy.
- Partner with suppliers who demonstrate ethical labour practices, transparency, and a commitment to sustainable water management.
- Favour suppliers engaged in corporate social responsibility (CSR) initiatives, particularly those addressing water conservation and community welfare.

5.2.7 Purchase and Procurement

5.2.7.1 Water-Efficient Fixtures and Fittings: The college focuses on acquiring low-flow faucets, dual-flush toilets, aerators, and sensor-operated handwashing stations to minimise excessive water usage in restrooms, labs, and kitchens. Future procurement policies will ensure that only verified water-saving fixtures are installed in new constructions or renovations.

5.2.7.2 Sustainable Landscaping Supplies: In selecting materials for gardening and greening initiatives, preference will be given to native plant species, soil with good moisture retention, and mulching materials that help reduce the need for watering. The Biodiversity Management Committee will be encouraged to choose landscaping elements that require minimal irrigation.

5.2.7.3 Green Cleaning Products: The college advocates for the use of biodegradable, low-water cleaning solutions in hostels and academic buildings, which limit the need for excessive rinsing and help prevent contamination of greywater systems.

5.2.7.4 Water-Sensitive Cafeteria Supplies: Cafeteria and canteen operations are encouraged to minimise the purchase of products that require a lot of water for production (such as disposable packaged foods). Instead, reusable crockery and water-efficient dishwashing practices will be prioritised.

5.2.7.5 Departmental Procurement Guidelines: Departments should evaluate the water impact of materials and laboratory equipment before making purchases. Guidelines will be distributed to help in selecting items that either reduce water usage or promote better management practices.

5.2.8 Research Innovation

The college emphasises research as a vital catalyst for innovation in water management and will actively promote research, discussion forums, and deliberations on topics such as water use efficiency, greywater treatment technologies, aquifer recharge methods, and the socio-environmental implications of water policies. Faculty and students will be encouraged to engage in these scholarly pursuits to generate insights and solutions that contribute to sustainable water practices.

5.2.8.1 Annual Water Audits:

The detailed audits of water usage patterns (generated manually or by flow meters and digital tools) will generate a wealth of empirical data that can serve as baseline research material for student projects, dissertations, or inter-institutional collaborations.

5.2.8.2 Data-Driven Research and Optimisation:

Automated sensors and meters installed across the campus will continuously collect water usage data, which will be processed through predictive analytics and modelling tools. This data-centric approach will not only optimise water consumption but also serve as a foundation for academic research, generating insights for publications and institutional improvement.

5.2.8.3 Multidisciplinary Research, Dissemination, and Deliberation:

The college will promote collaborative research on water sustainability, including the treatment and reuse of greywater from residential and institutional facilities for non-potable applications. Students will be encouraged to participate in externally funded projects, and findings from these studies will be shared through conferences, peer-reviewed journals, and campus-based forums, fostering informed discussions and policy-oriented deliberations.

5.2.9 Community Engagement

Recognising the college's role as a community influencer and change agent, the Water Policy 2025 includes a robust component of community engagement and capacity building.

5.2.9.1 Awareness Drives for Local Residents:

The college will organise street plays, mural exhibitions, and public lectures on water-saving practices, targeting nearby residential colonies, local schools, and women's groups.

5.2.9.2 Workshops and Skill Training: Hands-on training sessions will be conducted to demonstrate low-cost rainwater harvesting, simple greywater filtration systems, and home-based leak detection methods. These workshops will aim to empower households to adopt eco-friendly water practices.

5.2.9.3 Water Quality Testing Camps: At regular intervals, the college will host community water testing camps, providing free or subsidised analysis of drinking water quality for residents. These camps will also offer education on interpreting test results and ensuring safe water consumption.

5.2.9.4 Student-Led Outreach Programs: As part of the curriculum, students will administer outreach projects such as conducting surveys, awareness programs, and home audits in the surrounding areas, creating a two-way learning process between the institution and the community.

5.2.10 Monitoring and reporting

To ensure the effective implementation and continual improvement of the Water Policy, a rigorous monitoring and action framework will be adopted:

5.2.10.1. Feedback Mechanism for Water Management:

The Water Management Committee (WMC), comprising faculty, administrative staff, technical personnel, and student representatives, will function as the core governing body responsible for setting goals, monitoring implementation, and ensuring policy compliance. To support responsive action, the college will establish accessible feedback systems, including suggestion boxes and digital platforms, for promptly reporting water-related issues such as leaks and wastage. Regular water quality testing will be conducted to ensure both potable and recycled water meet health and hygiene standards. Feedback and test results will be reviewed periodically, guiding the continuous refinement of

water management strategies to ensure effectiveness, accountability, and adaptability to emerging needs.

5.2.10.2 Quarterly Water Usage Surveys and annual audits

The college will implement a comprehensive monitoring and evaluation system to ensure effective water conservation. Quarterly surveys will be conducted to analyze water consumption patterns at both departmental and campus-wide levels. The insights gained will support the recalibration of strategies and the setting of micro-targets for improved efficiency. Regular review meetings involving the Water Management Committee, departmental representatives, and maintenance teams will be held to evaluate progress, address challenges, and reinforce best practices. In addition, the institution will retain the register and document to conduct periodic inspections and preventive maintenance of pipelines to detect and promptly repair leaks, thereby minimizing water loss and preserving the integrity of the distribution system. Annual water audits will be carried out to identify high-consumption zones and inefficiencies. Automated monitoring tools, including smart water meters, will be installed to capture accurate data, which will guide data-driven conservation measures. Furthermore, water-saving fixtures such as sensor-based taps, dual-flush toilets, and low-flow fittings will be systematically installed across the campus to enhance usage efficiency and support long-term sustainability goals.

5.2.10.3 Key Performance Indicators (KPIs):

Each department will be assigned clearly defined and measurable Key Performance Indicators (KPIs) related to water consumption and conservation practices. These KPIs will be reviewed on a semi-annual basis to promote departmental accountability, goal-oriented planning, and proactive engagement in water-saving initiatives. Departments will be empowered to track their water usage, implement corrective measures, and contribute meaningfully to the institution's broader sustainability targets. To further enhance water conservation, greywater recycling systems will be installed across the campus. These systems will treat wastewater from sinks, showers, and washing areas using appropriate filtration and disinfection methods, ensuring the treated water is safe for reuse. The recycled water will be redirected for non-potable applications such as toilet flushing and garden irrigation, thereby substantially reducing the demand for fresh potable water. A structured maintenance schedule will be implemented to maintain operational efficiency and ensure compliance with health and safety standards. Additionally, maintenance personnel will receive regular training to manage and monitor the greywater systems effectively.

5.2.10.4 Maintenance and Response Protocol:

A dedicated response team will be established to promptly address and record water-related issues such as leaks, faulty fixtures, and blockages. To ensure accountability and continuous improvement, maintenance activities will be systematically documented through detailed logs tracking the frequency of issues and resolution times. Future infrastructure projects on campus will be required to incorporate rainwater harvesting and greywater recycling systems from the initial design and construction stages, embedding sustainability into the core of campus development. Before approval, comprehensive environmental impact assessments will be conducted to evaluate potential impacts on water resources and recommend mitigation measures. Furthermore, the architectural and operational design of new buildings will be aligned with sustainable water management principles, ensuring that each development supports the institution's long-term environmental objectives.

5.2.10.5 Use of Technology: The integration of flow meters, smart sensors will provide real-time monitoring, enabling faster decision-making and precision in resource management.

5.2.11 Compliance and Review

The institution is committed to upholding all applicable environmental laws, regulations, and standards related to water use, conservation, and management. Compliance will be ensured through the following measures:

- Adhere strictly to national, state, and local regulations on water usage, wastewater treatment, and pollution control.
- Maintain accurate records and documentation to demonstrate compliance during audits or inspections.
- Establish clear responsibilities within departments to

oversee compliance with the policy.

- Regularly monitor water use, efficiency measures, and procurement practices to ensure alignment with sustainability objectives.
- Conduct an annual review of the Water Policy to assess effectiveness, identify gaps, and adapt to emerging environmental challenges or opportunities.
- Update the policy to reflect advancements in technology, best practices in water management, and changes in legal requirements.
- Engage stakeholders, including staff, students, and external partners, in the review process to ensure continuous improvement and ownership.

5.2.12 Leadership And Accountability

Leadership commitment is pivotal to policy success. The college's management will ensure that water sustainability is an integral part of strategic planning and infrastructure development.

5.2.12.1 Policy-Embedded Infrastructure Planning:

Every new building or renovation project will include mandatory rainwater harvesting and greywater recycling systems, as per design and construction codes.

5.2.12.2 Environmental Impact Assessments (EIA):

Before the approval of major projects, comprehensive EIAs will be conducted to predict and mitigate any adverse impact on water resources.

5.2.12.3 Reporting and Transparency:

The WMC will publish an annual water efficiency report, sharing data, strategies, and achievements with internal and external stakeholders. This fosters a culture of transparency and participatory governance.

5.2.12.4 Communication channel:

Meeting, collaborative discussions led to several key decisions, which will be documented in the Minutes. This approach ensures that all participants are engaged, and their feedback on meeting updates will be disseminated through the departmental group or notice board, as appropriate to the needs and requirements of the team.

5.2.12 Conclusion

By implementing this comprehensive Water Efficiency Management Policy, our college aims to lead by example in environmental stewardship. With structured methodologies, resource optimisation, and strong leadership, we aspire to achieve our goal of reducing water usage by 50% by 2026. This initiative not only ensures sustainability within the campus but also sets a benchmark for community-driven conservation efforts.

5.3 METHODOLOGY

A comprehensive water efficiency assessment, essential for sustainable progress, evaluated water consumption and maintenance practices throughout the college. The methodology for the audit included a ground-level survey carried out by a team of ten members (twelve students and seven faculty) following a predetermined schedule. The team was divided into specialised groups to carry out tasks such as documenting activities, inspecting plumbing fixtures, and performing site evaluations on a block-by-block basis. The organised audit relied on eight different registers and five main guiding documents.

5.3.1 Internal Audit Training

Green audit training executes detailed, participatory methods to cultivate a sense of ownership and involvement within the institution. To prepare the college for this initiative, the implemented Environmental Management System (EMS) identifies students and faculty for training as internal auditors. This one-day course certifies participants as internal auditors, enabling them to perform a water audit. The internal water audit procedure consists of several essential phases: evaluation, risk assessment, data gathering, policy development, and the creation of records and programs for water conservation and resource management.

5.3.2 Water Infrastructure Survey

The internal audit team conducted a comprehensive survey of the water infrastructure. This process included cataloguing taps and faucets according to their type and quantity, evaluating their condition, and specifically noting the locations and counts of any leaks. The team created a map of all water sources for each block,

including external sources, and recorded the details of water storage systems, such as type, capacity, year of installation, and placement. This information enabled an evaluation of the functionality of the infrastructure (taps, faucets, pumping lines). The audit also included an analysis of water quality, an assessment of water risk management strategies, and a review of maintenance practices.

5.3.3 Sampling Data Collection of Nine Water Meters

To oversee water distribution, flow meters were installed at five sites where main lines emerge from their designated sources or tanks. Meter readings were collected over three weeks during planned sampling days. Simultaneously or independently, based on the actual procedures, pump operating times and related water volumes were recorded in triplicate throughout a nine-day observation period. The data gathered, which included date, time, volume, and duration measures, enabled calculations of flow rates.

5.3.4 Registers for the Monitoring and Analysis

The audit subsumes an evaluation of water footprint records, examination of consumption trends, grey water recycling systems, strategies for reducing water loss, and thorough management of water resources. Additionally, organised documentation of meetings and initiatives centred on water conservation and sustainability created a solid baseline of the college's existing water resources and practices.

5.3.5 External Auditing

Following the completion of the internal audit, an external auditor arrives at the college to assess compliance and identify any non-conformities related to the water management audit standards. In cases where only minor non-conformities are identified, the external auditor can grant the institution certification in alignment with the applicable ISO standards.

5.3.6 Assumption

The global challenge of water scarcity is critical and increasingly urgent, necessitating proactive solutions. To address this concern and promote water conservation in non-domestic sectors, organisations should adopt sustainable water management practices. The ongoing shortage of freshwater, made worse by consumption habits, high agricultural and industrial demands, and climate change, calls for improved resource management. Although freshwater supplies cannot be expanded, their management can be refined through a structured approach that includes enhancing water efficiency, utilising consumption analysis tools, and implementing systematic conservation efforts. This approach not only yields significant savings in water and energy but also lessens environmental impacts.

By aligning water management strategies with established standards, such as those specified in ISO 46001, organisations can reap considerable benefits. This alignment involves incorporating water resource identification into organisational planning and financial decisions, optimising water demand, enhancing management of usage, and promoting accountability by emphasising potential societal impacts. Regular evaluation procedures uncover chances for efficiency improvements, resulting in operational savings through conservation technologies, sustainable design, and careful monitoring. Thorough audits of critical infrastructure elements—from source and treatment facilities to distribution systems and end-users—are vital for detecting water losses, supporting system enhancements, and ensuring water quality via systematic monitoring, which guides the development of suitable treatment systems. Assessing leaks is a fundamental component of this evaluation process.

5.3.7 Water Footprint Verification

The critical role of water usage within national sustainability initiatives highlights the necessity for reliable and comparable data to enable effective regulation. ISO 14046 meets this need by providing a standardised approach for assessing and reporting water footprints, emphasising precision through independent verification protocols. There is a growing interest among stakeholders, consumers, and international organisations in the water performance of corporations, focusing on the overall water footprint, which encompasses both direct and indirect water usage along with associated environmental effects. As a result, the ISO 14046 standard was created to offer a solid framework for these evaluations. It aids in determining the water footprints for entities, processes, and products, assessing not only the volumes of water consumed but also the potential

environmental impacts. ISO 14046 assessments can be executed independently, focusing specifically on water-related effects, or integrated into a broader life cycle assessment (LCA). With increasing pressures in the 21st century, such as climate change leading to diminished water resources, businesses need to implement effective water management strategies. Leveraging ISO 14046 and its verification process, often supported by training programs (e.g., SGS), allows organisations to credibly showcase their commitment to responsible water management.

5.3.8 Stages of Water Audit

Water audit has the following three phases:

5.3.8.1 Pre audit phase

- Formation of audit team; scheduling audit programmes
- Setting up of scope and objectives (in tune with the water conservation policy of the institution)
- Discuss with the responsible persons of each location (staff, teachers, lab assistants, sweepers, watchmen, students, etc.) about the usage pattern and habits related to water consumption.

This phase includes the following specific activities:

5.3.8.1.1.System audit (inventory of infrastructure)

- The current water usage and systems for water use under various sectors, such as canteen, toilets, departments, common facilities, wash areas, and others, need to be studied to check their operational efficiency and level of maintenance.
- The scope for any modification or up-gradation will depend on the status of existing systems.

5.3.8.1.2.Water Supply and Usage audit (Usage pattern of the campus)

- Water audit comprises the preparation of a layout of water sources, distribution network, and service/delivery points to water users (lab, mess, canteen, toilets, office, public etc.) and return flow of waste or excess water.
- The layout should include locations and capacities of flow measurement devices installed at key points, dimensions of pipes and fittings in the water supply system, locations and particulars of flow control devices and history sheets of all measuring and control devices including pipes and fittings.

5.3.8.2 Audit phase

Auditors collect all data collected to ensure that nothing is overlooked completely in the audit. The following information regarding process has been collected during the audit phase:

- Flow measurement devices may be installed at all strategic points so that water losses from various components such as raw water source, conveyance system from raw water source to treatment plant, from treatment plant to treated water storage system, treated water storage system to distribution networks, individual users, etc. could be assessed at regular intervals (WEMS).
- Such an audit will also prove useful for future extension, renovation, and modernization of the system.
- Water quality of the distribution system needs to be monitored regularly at strategic points to find out the level and nature of contaminants present in the supplied water. Depending on the types of application and degree of purity needed, the treatment system can be designed and developed.
- The water distribution system, leakage assessment etc., will form an integral part of this study.

5.3.8.3 Post audit phase

- The plan of action for the post-audit phase is implementation and follow-up. The result is to assist and implement or enhance existing WEMS with sustainability solutions and monitor the performance.
- WEMS committee will ensure that the WEMS is in place and the college is participating, by making the entire college/university community well informed through regular communications, monitoring through periodical evaluation programmes etc.

Two major activities are included in this phase:

5.3.8.3.1.Source sustainability audit

- A study of the availability of water from the current sources and past consumption patterns for various sectors of the college/university is necessary to understand the present water utilization and project future requirements.
- Data on the development of a sustainable source of water through rainwater harvesting and wastewater (grey water) recycling should also be taken into consideration.
- Water conservation measures shall be identified and included in the action plan.

5.3.8.3.2.Discharge audit

- The quantity of grey water from all points of water usage shall be calculated. Based on such statistics, recycling or wastewater treatment options shall be implemented.

5.3.9 Steps of Water Audit

The standard water balance or methodology is the framework for categorizing and quantifying all water uses in the water audit. It is called a 'balance' because when it is completed, all uses of water in the system equal the amount of water input by the sources.

5.3.9.1 . Site assessment

Collection of contour maps and campus diagrams

- Preparing an inventory of the water infrastructure of each building:
    - Water meter data (from various points of use)
    - Data on the quantity of water pumped every day (pump-wise/location-wise)
    - Data on leaking infrastructure and the quantity of lost water
    - List of water conservation measures (WCM) and sustainability measures (SM) implemented
    - Discussion with responsible persons of each infrastructure (on utility method, working condition, operation and maintenance procedures etc.)
    - Date entry in prescribed forms (water spread sheets)

5.3.9.2 . Data analysis

- Analysis of current and past performance (water usage data and water loss data, before and after the implementation of WCM, SM etc.)
- Regression analysis involves the comparison of water consumption on the Y axis versus the potential water driver on the X axis (weather, working days/holidays etc.).
- Preparation of checklists and verification
- Water footprint calculation

5.3.9.3 . Final audit by external audit team

- Checklists verification- identifying non-conformities
- Action plan –long-term and short-term
- Final report & certification as per ISO standards.

5.3.10. Work Plan and Schedule of Water Audit

DATE	Work Plan
18-03-25 to 22-03-2025	Surveying to assess the quantity and types of taps and faucets, as well as their operational status in each section of the College Campus.
17-03-25 to 22-03-25	Mapping each area of the campus to locate water sources, including those situated outside the campus perimeter, if applicable.
10-06-25 to 14-06-25	Evaluating the functionality of taps, faucets, and plumbing systems (pipes and fittings) and categorising their condition as Good, Poor, or Moderate.
24-06-25 to 28-06-25	Sampling of manual water dicharge from each tap . Prepare water managment policy and plan
8-07-25 to 12-07-25	Detecting water loss through an on-site audit.
15-07-25 to 19-07-25	Initiating programs focused on water conservation and sustainability.

Table No.5.1 Schedule of water management audit

Activities	Frequency	Dates of study	Mode of data collection
Usage pattern and quantity of water. Documentation of current WEMS practices. Grey water quantity from each section	Walk-through audit and interviews with system managers (controlling or responsible staff or teachers)	Collect data on water usage from each section of every division of the college (for eg, in the canteen, how much water is used for hand wash, cooking and its preparation, cleaning utensils, floor, table etc.	Entry in the given formats
Details of present water sources & Water tank details	Type (open well, pond, tube well, etc.), external sources (water supply)	Prepare a detailed inventory on every current water resource (capacity, sustainability etc.)	Entry in the given format
Alternate water resources (eg., Rain water harvesting systems)	Documents details of present alternate water resources in the campus	Identify possible alternate water sources water sampling 24/06/2025 - 28/06/2025	Entry in the given format Include in the action plan

Table 5.2 Work plan of water management audit

5.4 RESULT AND DISCUSSION

5.4.1 Water sources of the institution: an overview

Sl No	Water source	Location	Volume (m^3) or size of the pond (Radius x depth or length x breadth x depth)
1	Well	Hostel	8m
2	Well	Inside the campus	8m

Tabel 5.3 Water source of the college

Fig 5.1 Water source like well or and give caption

4.4.2 Water storage & infrastructure

Sl No	Type	Capacity (litres)	Year of Installation	Location	Water Source	Building to which delivery	Purpose of water	How many times daily are filled
1	Tank	25000	1990	Roof of the main Building	Well	Main building and Tank of Common toilets	Washing Hygiene purpose	Twice a day
2	Tank	4000	2005	Roof of Hostel	Well	Hostel	Washing Hygiene purpose, Cooking	Thrice a day
3	Tank	1000	2018	Roof of Common Toilet Area	Main Tank	Common Toilet area	Washing Hygiene purpose	Twice a day
4	Tank	1000	2018	Roof of Common Toilet Area	Main Tank	Common Toilet area	Washing Hygiene purpose	Twice a day
5	Rainwater collection tank	25000	2021	Near Auditorium	Main Tank	NA	NA	Twice a day

Table 5.4 Water storage of the college and hostel

Fig 5.2 Water tank

Sl No	Type	Capacity (litres)	Year of Installation	Location	Water Source	Building to which delivery	Purpose of water	How many times daily are filled
6	Filter	50	2018	Ground floor	Main Tank	Filter	Drinking	Twice a day
7	Filter	50	2018	Middle Floor	Main Tank	Filter	Drinking	Twice a day
8	Cooler	50	2018	Top Floor	Main Tank	Cooler	Drinking	Twice a day

Table 5.5 Water purification tank

The college's water supply system comprises two primary overhead tanks: a 25,000 L tank serving the main building and a 4,000 L tank serving the hostel. In addition, there are three sub-tanks with the following capacities: one 4000 L tank,1000L, 1000L one 25,000 L tank. Tow filter of capacity 50 L and cooler of 50 L distributed from main tank

These sub-tanks are manually filled, typically three times per day for the hostel sub-tanks and twice per day for the others. The filling frequency may vary depending on water demand, seasonal conditions, and the number of occupants.

Fig 5.3 Water filter photos

5.4.3 Water infrastructure and fixature

Sl No	Ground Floor	Tap	Flush	Faucet
1	114 Chemistry Lab	21	0	0
2	110 III rd B.Sc. Chemistry	1	0	0
3	112 Dept. of Chemistry	1	0	0
4	110 Dept. of Commerce	1	0	0
5	119 Dept. of Mathematics	1	0	0
6	Reception Cooler	2	0	0
7	Faculty Toilet	5	3	3
	Total	32	3	3

Table 5.6 Ground floor infrastructure and fixature

Fig 5.4 Periyar River Valley Irrigation Canal Perumbavoor

Sl No	Middle	Tap	Flush	Faucet
1	Department of Physics 202	1	0	0
2	Office	2	0	0
3	Management Office 211	2	0	0
4	Zoology Lab 204	2	0	0
5	Zoology Department 206	1	0	0
6	Principal room	2	0	0
7	Physics Lab 201	2	0	0
8	Cooler	2	0	0
9	Toilet	3	2	2
10	Department of Malayalam & Hindi 220	1	0	0
	Total	18	2	2

Table 5.7 Middle floor infrastructure and fixature

Sl No	Top Floor	Tap	Flush	Faucet
1	Dept. of English 304	1	0	0
2	Dept. of History 314	1	0	0
3	B Block Cooler	2	0	0
4	Zoology Lab 325	4	0	0
5	Dept. (Zoology & B. Com CA) 320	1	0	0
7	Water Filter	2	0	0
8	Toilet (Near 319)	3	2	2
9	Wash area	4	0	0
10	Toilet	1	0	0
	Total	19	2	2

Table 5.8 Top building infrastructure and fixature

Fig 5.5 Water Supply Fixtures and Infrastructure- Hostel

Sl No	Outside	Tap	Flush	Faucet
1	Wash Area	12	0	0
2	Toilet near Auditorium	3	0	0
3	Canteen	7	0	0
4	Common Toilet	14	7	7
5	B Block	1	0	0
6	E Block	1	0	0
7	In front of the Chemistry Dept.	1	0	0
8	In front of College	1	0	0
	Total	40	7	7

Table 5.9 Outside infrastructure and fixature

Sl No	Hostel	Tap	Flush	Faucet	Shower
1	Ground Floor - Mess Hall	2	0	0	0
2	First Floor Toilet 1	7	4	0	0
3	First Floor Toilet 2	14	4	0	2
4	Second Floor Toilet 3	14	4	3	7
5	Second Floor Toilet 4	7	4	0	0
	Total	44	16	3	9

Table 5.10 Hostel infrastructure and fixature

The college's water supply system consists of two main overhead tanks: a 25,000-litre tank for the main building and a 4,000-litre tank for the hostel. Additionally, there are three smaller sub-tanks with capacities of one 4,000-litre tank and two 1,000-liter tanks, along with another 25,000-litre tank. It also includes two 50-litre filters and a 50-litre cooler that are supplied from the main tank., including one dedicated to rainwater harvesting with a capacity of 25,000 litres. The water infrastructure is strategically distributed across several key areas, with the hostel being the largest facility. It features forty-four taps, sixteen toilets, three faucets, and nine sprinklers, providing suitable accommodations for the 57 residents. The ratio of approximately 3.56 inmates per toilet exceeds standard recommendations of one toilet for every 5 to 10 inmates, thereby ensuring adequate access to personal hygiene facilities. The availability of forty-four taps, approximately 1.76 inmates per tap, offers ample opportunities for water access. However, the limited number of three faucets may present a slight challenge during peak washing times. The water infrastructure facilities extend to other areas, including the outdoor space with fourteen taps, seven toilets, and seven faucets; the ground floor, which has thirty-two taps, three toilets, and three faucets; the top building featuring nineteen taps, two toilets, and two faucets; and the middle floor with eighteen taps, two toilets, and two faucets. Overall, the infrastructure is designed to cater to a total strength of 520, and the provision of sixteen toilets aligns well with guidelines suggesting one toilet per 25 to 50 people, effectively accommodating the needs of the college community. The comprehensive distribution of taps and faucets throughout the campus enhances accessibility to water and restroom facilities, fostering convenience and promoting hygiene. Nonetheless, the addition of more toilets and handwashing stations could further mitigate congestion during peak usage times. Overall, the existing infrastructure provides a foundation to support the requirements.

5.4.4 Water leakage status

No:	Room No:/Block (Specify landmark if necessary)	Type of tap (Screw/Disc/Press)	Quantity of water leaking in litres/hour
1	Department of Zoology 206	Disc	6.8
2	Toilet faucet, Students' Wash area		38.0

Table 5.11 Water leakage area and its quantity

Based on an assessment of water leakage, an estimated 44.8 liters of water were lost per day. This amounts to an annual loss of approximately 16,352 liters. The leaks were identified from two main sources: 6.8 liters per day from a tap in the Zoology department and 38.0 liters per day from a toilet faucet in the student wash area.

5.4.5 Overview of manual water consumption trends and usage patterns.

No. of Taps	Rate (L/min)	Total (L/min)	Per Capita
16	2.35	37.64706	0.072398
4	3.16	12.63158	0.024291
1	6.85	6.849315	0.013172
1	5.24	5.235602	0.010068
2	3.56	7.125891	0.013704
5	2.88	14.38159	0.027657
14	2.68	37.46655	0.072051
14	1.57	22.04724	0.042399
7	2.86	20.03817	0.038535
2	2.77	5.535055	0.010644
5	4.20	20.97902	0.040344
1	2.27	2.269289	0.004364
1	1.03	1.034483	0.001989
1	3.37	3.367003	0.006475
1	1.73	1.734104	0.003335
1	1.88	1.878522	0.003613
76		200.22	0.39

Table 5.12 Ground (Half) manual water discharge

Fig 5.6Field-Based Manual Water Discharge Collection- Zone one

No. of Taps	Rate (L/min)	Total (L/min)	Per Capita
16	3.93	62.82723	0.120822
4	7.44	29.77667	0.057263
1	11.11	11.11111	0.021368
1	6.15	6.147541	0.011822
2	6.00	12	0.023077
5	3.23	16.14639	0.031051
14	5.00	70	0.134615
14	5.81	81.39535	0.15653
7	7.50	52.5	0.100962
2	10.00	20	0.038462
5	6.74	33.70787	0.064823
1	3.69	3.694581	0.007105
1	1.67	1.666667	0.003205
1	8.02	8.02139	0.015426
1	2.39	2.394254	0.004604
1	3.12	3.115265	0.005991
76		414.50	0.80

Table 5.13 Ground (Full) manual water discharge

No. of Taps	Rate (L/min)	Total (L/min)	Per Capita
1	3.030	3.030303	1575.758
2	7.126	14.25178	7410.926
2	2.335	4.669261	2428.016
2	4.093	8.185539	4256.48
1	3.040	3.039514	1580.547
1	2.580	2.579536	1341.359
1	3.571	3.571429	1857.143
2	6.289	12.57862	6540.881
2	2.459	4.918033	2557.377
1	3.125	3.125	1625
2	3.279	6.557377	3409.836
1	2.000	2	1040
18		68.51	0.13

Table 5.14 Middle (half) manual water discharge

Fig 5.7 Field-Based Manual Water Discharge Collection- Zone two

No. of Taps	Rate (L/min)	Total (L/min)	Per Capita
1	7.833	7.832898	0.015063
2	7.634	15.26718	0.02936
2	2.849	5.698006	0.010958
2	6.772	13.54402	0.026046
1	4.839	4.83871	0.009305
1	3.064	3.064351	0.005893
1	7.500	7.5	0.014423
2	6.637	13.27434	0.025528
2	3.571	7.142857	0.013736
1	5.455	5.454545	0.01049
2	7.317	14.63415	0.028143
1	3.000	3	0.005769
18		101.25	0.19

Table 5.15 Middle (full) manual water discharge

No. of Taps	Rate (L/min)	Total (L/min)	Per Capita
1	3.030	3.030303	0.005828
2	7.126	14.25178	0.027407
2	2.335	4.669261	0.008979
2	4.093	8.185539	0.015741
1	3.040	3.039514	0.005845
1	2.580	2.579536	0.004961
1	3.571	3.571429	0.006868
2	6.289	12.57862	0.02419
2	2.459	4.918033	0.009458
1	3.125	3.125	0.00601
2	3.279	6.557377	0.01261
1	2.000	2	0.003846
18		68.51	0.13

Table 5.16 Top (half) manual water discharge

No. of Taps	Rate (L/min)	Total (L/min)	Per Capita
1	4.286	4.285714	0.008242
2	6.522	13.04348	0.025084
2	4.505	9.009009	0.017325
2	2.256	4.511278	0.008676
1	2.239	2.238806	0.004305
1	5.736	5.736138	0.011031
1	7.299	7.29927	0.014037
2	6.452	12.90323	0.024814
2	4.777	9.55414	0.018373
1	6.224	6.224066	0.011969
2	2.287	4.573171	0.008795
1	2.347	2.347418	0.004514
18		81.73	0.16

Table 5.17 Top (full)manual water discharge

No. of Taps	Rate (L/min)	Total (L/min)	Per Capita
11	18.519	203.7037	0.391738
1	4.335	4.33526	0.008337
3	6.757	20.27027	0.038981
3	4.208	12.62272	0.024274
4	15.306	61.22449	0.117739
11	5.051	55.55556	0.106838
3	3.593	10.77844	0.020728
1	3.836	3.836317	0.007378
1	7.009	7.009346	0.01348
1	2.340	2.340094	0.0045
1	5.650	5.649718	0.010865
40		387.33	0.74

Table 5.18 Outside (half)manual water discharge

No. of Taps	Rate (L/min)	Total (L/min)	Per Capita
11	31.915	351.0638	0.675123
1	5.758	5.758157	0.011073
3	7.426	22.27723	0.042841
3	4.405	13.21586	0.025415
4	22.388	89.55224	0.172216
11	11.321	124.5283	0.239478
3	10.135	30.40541	0.058472
1	16.304	16.30435	0.031355
1	9.036	9.036145	0.017377
1	10.989	10.98901	0.021133
1	8.929	8.928571	0.01717
40		682.06	1.31

Table 5.19 Outside (full)manual water discharge

No. of Taps	Rate (L/min)	Total (L/min)	Per Capita
2	4.33	8.660	0.152
5	4.46	22.300	0.391
14	4.02	56.280	0.987
14	3.26	45.640	0.801
7	4.42	30.940	0.543
2	7.43	14.860	0.261
44	4.33	178.680	3.135

Table 5.20 Hostel (half open)manual water discharge

No. of Taps	Rate (L/min)	Total (L/min)	Per Capita
2	4.41	8.820	0.155
5	4.87	24.350	0.427
14	4.96	69.440	1.218
14	6.73	94.220	1.653
7	5.10	35.700	0.626
2	10.51	21.020	0.369
44	4.41	253.550	4.448

Table 5.21 Hostel (full open) manual water discharge

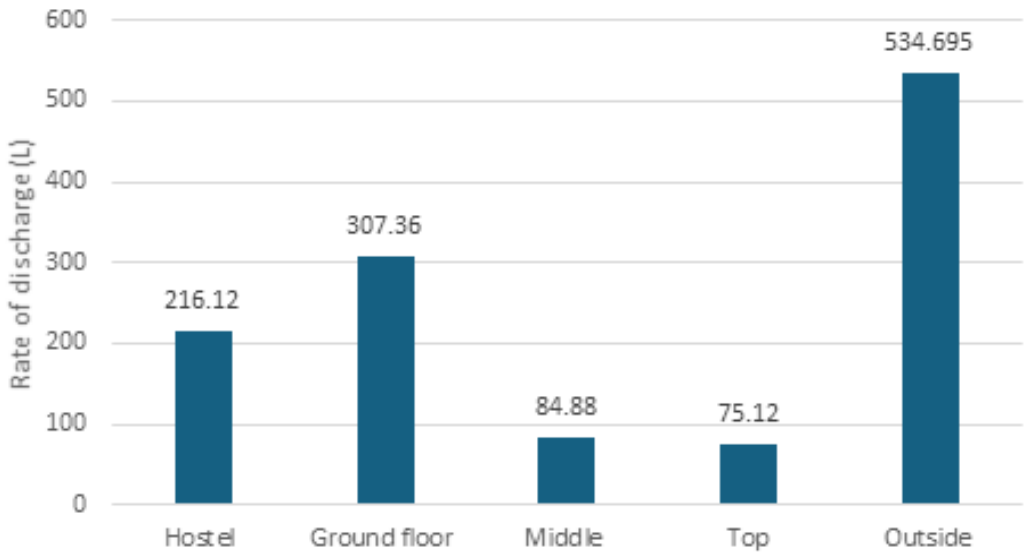


Fig 5.8 Annual water consumption based on manual water discharge

The college's yearly average water usage stands at 201682 litres, with a per capita usage of 387.85 litres. 43224 litres in the hostel. The utilisation of the hostel facilities exceeds that of the college, as it accommodates 57 members whose regular activities, including sanitation, culinary preparation, laundering, and personal hygiene practices, contribute to an increased demand for services. This discrepancy may arise from varying usage patterns and the strength of users, suggesting a need for better water management practices. To ensure an adequate water supply and effectively manage potential fluctuations in demand, the campus is currently equipped with four water tanks, each with capacities ranging from 1,000 to 25,000 litres, alongside infrastructure facilities on each floor. Given the presence of 109 infrastructure units, which likely include dormitories, classrooms, and recreational facilities, maintaining a steady supply of water to support the needs of students, faculty, and staff is essential. This diverse range of tank sizes allows for flexible storage solutions and helps to protect against shortages during peak usage times or emergencies. To align with international guidelines and promote sustainability, it is recommended that the college conduct a thorough assessment of its water usage patterns. Implementing measures such as water recycling systems and promoting water conservation practices among users to enhance water conservation initiatives. Continued education and initiatives aimed at encouraging students and staff to adopt sustainable water use behaviours will further support the college's commitment to resource optimisation and environmental stewardship. Adapting these strategies will not only ensure compliance with international standards but also enhance the campus's resilience against water scarcity.

5.4.6 Annual grey water released

Total grey water released (L)		
Sl No	Room No:/Block (Specify landmark if necessary)	Rate of discharge of grey water in litre/day
1	Chemistry Lab	21.60
2	Physics Lab	0.05
3	Zoology Lab	1.80
4	Botany Lab	0.60
5	Zoology MSc Lab	3.00
6	College and Canteen wash areas	300.00
7	Hostel	500.00

Table 5.21 Grey water release of each location

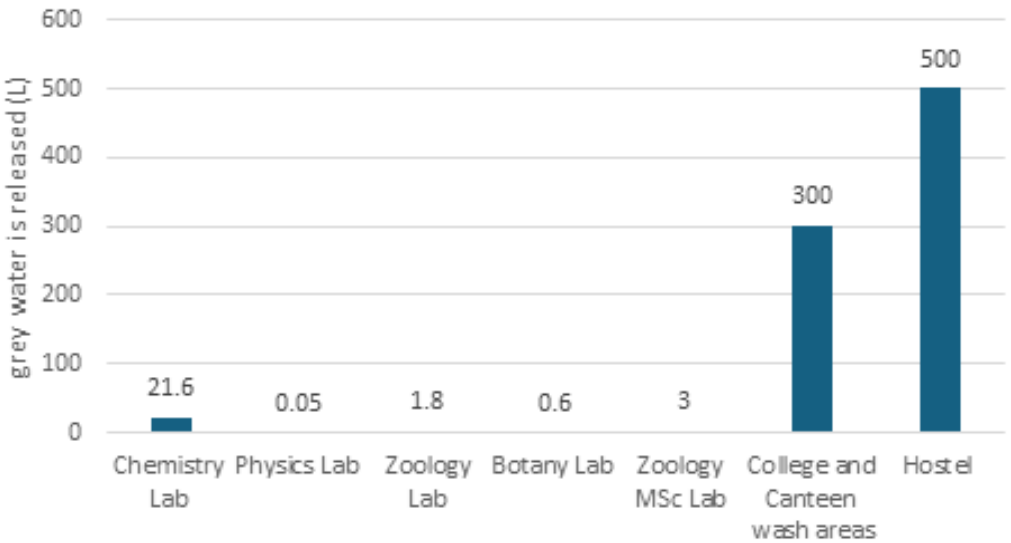


Fig 5.9 Annual grey water released based on manual water discharge

The college hostel and its associated canteen collectively generate an estimated 23,630,000 litres of greywater annually. This substantial volume arises from a range of domestic and operational activities, including cooking, dishwashing, cleaning, laundry, and personal hygiene practices among the residents.

Currently, this greywater is discharged through an open channel constructed by the institution and repurposed for irrigating gardens and vegetation. Wastewater originating from laboratories is conveyed separately via zinc pipes. No formal or dedicated treatment process is in place for the greywater prior to its reuse or discharge.

This practice highlights a significant opportunity for implementing structured greywater management and treatment systems to enhance environmental sustainability, improve water resource efficiency, and mitigate potential risks associated with untreated discharge.

5.4.7 Water motor pumping data

Date	Switch on	Switch 0ff	0verflow	Duration in minutes
04-Aug	8:25 AM	8:50 AM	No	25
04-Aug	12:45 PM	1:13 PM	Yes	45
05-Aug	12:14 PM	12:45 PM	No	31
06-Aug	8:14 AM	8:56 AM	Yes	42
08-Aug	8:18 AM	9:37 AM	Yes	77
09-Aug	10:24 AM	11:10 AM	Yes	46
10-Aug	9:27 AM	9:58 AM	No	31
11-Aug	8:12 AM	8:40 AM	Yes	28
12-Aug	11:03 AM	11:30 AM	No	27
13-Aug	8:14 AM	9:58 AM	No	44
14-Aug	8:25 AM	9:50 AM	Yes	25
15-Aug	4:15 PM	4:59 PM	Yes	44
16-Aug	4:22 PM	4:51 PM	Yes	29
18-Aug	8:40 AM	9:10 AM	No	30
19-Aug	10:17 AM	11:15 AM	Yes	58
20-Aug	10:37 AM	11:30AM	No	53
21-Aug	2:39PM	3:33 PM	Yes	4
23-Aug	10:15AM	10:45 AM	No	30
25-Aug	10:29 AM	11:45 AM	Yes	76
27-Aug	10:38 AM	11:20 AM	No	42
28-Aug	8:13 AM	8:43 AM	Yes	30
29-Aug	8:45 AM	8:57 AM	Yes	12
30-Aug	8:10 AM	8:20 AM	Yes	10
31-Aug	10:02 AM	10:30 AM	No	28
			Average	36.13

Table 5.22 Water pumping frequency record

Fig 5.10 Water Distribution Pump Room

The analysis of water pumping data reveals an average pumping duration of 36.13 minutes per cycle. The accompanying table clearly indicates that the motor operates twice per day on average. Furthermore, it documents instances of water overflow, which significantly contribute to an increased water footprint and elevated energy consumption. To address these inefficiencies and promote more sustainable operation, it is strongly recommended to transition to an automatic water pumping system. Such a system, equipped with software-based tracking and monitoring capabilities, can accurately record and optimise pumping frequency, prevent overflows, minimise unnecessary runtime, and substantially reduce both water wastage and energy usage. This upgrade would enhance overall system reliability, lower operational costs, and align with best practices for efficient resource management in water pumping applications.

Open Well – Secondary Water Source

5.4.8 Water quality testing report anaysis

Test Result – Chemical Discipline				
Parameter	Test Method	Unit	Result	Requirements as per the acceptable limit of IS 10500:2012
Colour	IS 3025 (Part 4): 2021	Hazen	1	5 (Max)
Odour	IS 3025 (Part 5): 2018	--------	Agreeable	Agreeable
Turbidity	IS 3025 (Part 10): 2023	NTU	0.10	1 (Max)
ph@25 C	IS 3025 (Part 11): 2022		6.85	6.50-8.50
Total dissolved solids @ 180^0 C	IS 3025 (Part 16): 2023	mg/L	65.8	500 (Max)
Total hardness as $CaCo_3$	IS 3025 (Part 21): 2009	mg/L	32.3	200 (Max)
Calcium as Ca	IS 3025 (Part 40): 1991	mg/L	8.00	75 (Max)
Magnesium as Mg	IS 3025 (Part 46): 2023	mg/L	2.95	30 (Max)
Chloride as Cl	IS 3025 (Part 32): 1988	mg/L	18.0	250 (Max)
Iron as Fe	IS 3025 (Part 53): 2003	mg/L	0.21	1 (Max)

Test Result – BIOLOGICAL DCIPLINE				
Parameter	Test Method	Unit	Result	Requirements as per the acceptable limit of IS 10500:2012
Total Coliform Bacteria	IS 15185: 2016	----------	Absent/100 ml	Absent/100 ml
E. colie	IS 15185: 2016	----------	Absent/100 ml	Absent/100 ml

Parameter	Test Method	Unit	Result	Requirements as per the acceptable limit of IS 10500:2012
Colour	IS 3025 (Part 4): 2021	Hazen	1	5 (Max)
Odour	IS 3025 (Part 5): 2018	--------	Agreeable	Agreeable
Turbidity	IS 3025 (Part 10): 2023	NTU	<0.10	1 (Max)
ph@25 C	IS 3025 (Part 11): 2022		7.02	6.50-8.50
Total dissolved solids @ 180^0 C	IS 3025 (Part 16): 2023	mg/L	49.2	500 (Max)
Total hardness as $CaCo_3$	IS 3025 (Part 21): 2009	mg/L	24.2	200 (Max)
Calcium as Ca	IS 3025 (Part 40): 1991	mg/L	6.40	75 (Max)
Magnesium as Mg	IS 3025 (Part 46): 2023	mg/L	1.97	30 (Max)

Chloride as Cl	IS 3025 (Part 32): 1988	mg/L	10.0	250 (Max)
Iron as Fe	IS 3025 (Part 53): 2003	mg/L	0.14	1 (Max)
Test Result – BIOLOGICAL DCIPLINE				
Parameter	Test Method	Unit	Result	Requirements as per the acceptable limit of IS 10500:2012
Total Coliform Bacteria	IS 15185: 2016	----------	Absent/100 ml	Absent/100 ml
E. colie	IS 15185: 2016	----------	Absent/100 ml	Absent/100 ml

Table 5.23 Water quality assessment

The water sample complies with all safety parameters and is deemed fit for drinking. However, to ensure the continued safety of drinking water, it is essential to conduct a water quality assessment twice a year, ideally every six months. Regular assessments help identify any potential contaminants or changes in water quality that could pose health risks. To emphasise the importance of cleaning water tanks and pipes where water flows. Over time, sediment, algae, and bacteria can accumulate in these areas, affecting the quality of drinking water. Therefore, water tanks should be cleaned biannually, and pipes should be inspected and flushed to remove any buildup. Furthermore, chlorination should be performed as needed to eliminate harmful microorganisms and ensure that the water remains safe for consumption. By prioritising these maintenance practices, we can significantly enhance the safety of our drinking water supply.

5.5 CONCLUSION

- The college is equipped with infrastructure that supports the demands of its community; however, it still relies on an outdated plumbing system. Currently, only college personnel are familiar with the locations of water storage and the corresponding distribution areas. When issues arise in the water delivery system, it necessitates shutting down the entire area to identify the problem. The single-line connections make it challenging for external personnel to access multiple areas, posing significant obstacles to diagnosing and resolving water connection issues.

- The annual water quantity is currently assessed based on manual discharge measurements from the pipes, which provides only a general overview of water consumption and lacks precision. To improve accuracy, the college should install water flow meter connections from the source to the delivery points to effectively calculate annual water usage. Based on these findings, the auditing team recommended the installation of water flow meters and the identification of the connection lines for water circulation in each area.

- The college benefits from an abundant water supply, primarily sourced through the Periyar Valley Irrigation Project's (PVIP) canal system, owing to its location in a well-irrigated region. This consistent availability may contribute to a lower emphasis

on water conservation initiatives. To address and transform this situation, the college could implement a structured, step-by-step approach: first, by developing a comprehensive mapping of water distribution across the campus to identify usage patterns and inefficiencies; and second, by transitioning to an automated pumping system to prevent overflows and optimise resource management.

5.6 RECOMMENDATION

- Install water flow meters and map pipeline networks: Install sub-meter flow meters at key water delivery points (e.g., hostels, labs, canteens, and administrative blocks) to monitor consumption in real-time. Simultaneously, conduct a detailed mapping of water connections and pipelines to each fixture/area. This will enable quick identification and isolation of leaks or issues in specific zones, preventing campus-wide disruptions. Collaborate with technical agencies (e.g., local water authority) or educational institutions (e.g., engineering departments from nearby colleges) for expertise in surveying and installation. Add IoT-enabled meters for data logging and alerts via a central dashboard.
- Regular water quality testing and maintenance: Perform comprehensive water quality testing (physical, chemical, and microbiological parameters) at least twice a year, preferably pre- and post-monsoon. Schedule cleaning and disinfection of overhead/underground tanks, fixtures, and pipelines biannually to prevent contamination and biofilm buildup. Maintain a logbook for records and involve students (e.g., from environmental science clubs) for hands-on learning.
- Strengthen rainwater harvesting systems: Even in the absence of current water scarcity issues, introduce rooftop rainwater harvesting with filtration and storage tanks to recharge groundwater and supplement non-potable needs. This promotes efficient water management, reduces dependency on municipal supply, and lowers the campus water footprint. Prioritise low-cost designs using existing rooftops and direct harvested water to landscaping or flushing systems.
- Collection and storage of surplus rainwater: The college plans to develop a dedicated water storage infrastructure to harvest and retain excess water from the canal. This system would enable utilisation during periods of peak demand or scarcity, proactively preparing for future water resource challenges even though the institution is not currently facing such constraints.
- Develop greywater treatment and reuse facilities: Install decentralised greywater treatment systems (e.g., constructed wetlands, bio-filters, or simple reed bed systems) to treat wastewater from hostels, laboratories, and canteens. The treated water can be safely reused for irrigation in campus eco-farming, gardens, or flushing toilets, significantly reducing freshwater demand. Begin with pilot units in high-generation areas and scale up based on performance.
- Upgrade to smart water infrastructure: Modernise pumping systems with automatic timers, level sensors, or mobile-app-controlled tracking for efficient operation and leak detection. Replace conventional taps with sensor-based or infrared automatic faucets in high-usage areas (washrooms, canteens) to eliminate wastage. These upgrades can reduce water usage by 30-50% with quick payback periods.
- Promote awareness through signage and campaigns: Install informative signage and digital displays across campus (near taps and common areas), highlighting the importance of water conservation, wise usage habits, and the campus's sustainability efforts. Complement with awareness programs, workshops, and student-led campaigns to foster behavioural change among the college community.

5.7 WATER EFFIECIENCY MANAGEMENT PLAN

5.7.1 Introduction

Water is a critical resource essential for life and development. As an educational institution, our women's college acknowledges the need to adopt sustainable water management practices. This policy document

outlines a comprehensive framework for an effective Water Efficiency Management System, supported by structured audits, conservation strategies, and education-based interventions to achieve sustainability. Our mission is to reduce water consumption by 50% by 2026, utilizing a blend of infrastructure, community engagement, and continuous monitoring.

5.7.2 Establish an Adopt Water Efficiency Management Team

- The Water Management Committee (WMC) will comprise faculty members, administrative staff, maintenance personnel, and student representatives.
- The committee will be responsible for developing water conservation policies, ensuring their implementation, and conducting regular water audits.
- They will also oversee infrastructure improvements, monitor consumption data, organise awareness programs, and create accountability through transparent reporting.
- The team will further coordinate training for staff and students on water-saving practices, ensuring a culture of sustainability.

5.7.3 Formulate a Comprehensive Strategy for Sustainable Water Management

- The Water Management Committee (WMC) will develop a comprehensive strategy that begins with an in-depth assessment of current water usage patterns across the campus. This strategy will outline specific water conservation measures, establish reduction targets with corresponding timelines, and identify necessary infrastructure upgrades, such as smart meters and dual plumbing systems.

- To promote behavioral change, the initiative will integrate educational programs and awareness campaigns, alongside collaborative efforts for exploring additional opportunities. The strategy will incorporate technologies such as rainwater harvesting, greywater recycling, and water-efficient appliances, while also seeking partnerships with environmental organizations for expert guidance and collaborative projects.

- In terms of academic integration, the curriculum will be enhanced with modules on water conservation, environmental management, and sustainability across at least five programs. This will include project-based learning, case studies, and fieldwork that enable students to research campus water usage, devise innovative conservation solutions, and participate in internships with environmental organizations, thereby cultivating a holistic understanding of sustainable water management.

- To further support this initiative, water-intensive lawns will be transformed with native, drought-resistant plant species, significantly reducing irrigation needs and enhancing ecological balance. The implementation of drip irrigation and mulching techniques will contribute to minimizing water wastage in landscaping efforts. Additionally, organic composting will be promoted to help improve soil moisture retention, alongside the establishment of a biodiversity park that showcases sustainable landscaping and effective water conservation practices.

- The campus water infrastructure will undergo regular maintenance, with proactive leak detection and repair measures in place, complemented by the use of smart water meters to enable precise monitoring for optimal resource management. Through data analytics, consumption patterns will be evaluated to identify areas for improvement, with a focus on endorsing water-efficient products such as sensor-based taps, low-flow toilets, and water-saving irrigation systems. Infrastructure choices will prioritize water conservation, including the installation of permeable pavements to facilitate rainwater percolation.

- This strategic plan will adhere firmly to principles of waste reduction, the reuse of greywater for non-potable applications, and the recycling of wastewater for gardening and sanitation purposes. Moreover, vendor selection criteria will emphasize compliance with sustainability standards and environmentally friendly practices.

5.7.4 Implement Effective Methods to Attain Set Objectives

- Annual Water Audits: Systematic audits will identify inefficient areas and help prioritize interventions.
- Installation of Systems: Comprehensive rainwater harvesting and greywater recycling systems will be installed across the campus.
- Water-Saving Fixtures: Fittings like sensor taps, low-flow fixtures, and dual-flush toilets will be standardized.
- Awareness Campaigns: Regular workshops, seminars, and competitions will cultivate water-saving habits.
- Smart Monitoring: Deployment of smart meters and data analysis tools will facilitate real-time monitoring.
- Quick Response Team: A specialized maintenance team will ensure immediate response to any water-related issues.
- Quarterly Reviews: Progress will be evaluated quarterly to ensure alignment with targets and strategies adjusted as needed.

5.7.5 Establish a Robust Communication Channel

Communication pathways through mail, staff and department what's app to ensure consistent updates and engagement:

- Students are trained and practiced through sessions, workshops, and participation in conservation projects more about the discipline and introduce new initiatives and the way to mitigate the challenges
- Teaching staff will receive regular updates during faculty meetings and encouragement to integrate conservation and sustainable development topics into coursework.
- Specialized training on water-efficient operational practices will be provide to students, staffs and non-teaching staffs by the faculties or with support of experts from the Respective institution
- Comprehensive reports and reviews are presented before the management committee periodically to guide the performance level and introduce new strategic decisions to future betterment
- Feedback will be collected via digital portals, suggestion boxes, and a dedicated helpline, ensuring a transparent and accountable communication system.

5.7.6 Set Both Long-Term and Short-Term Goals

5.7.6.1 Short-term goal

- Conduct thorough audits and map the water distribution of the college and fix automatic system instead of manual
- Integrate 40% of academic subjects related to Sustainable Development Goals (SDG) and resource management.
- Schedule regular water quality assessments and perform semi-annual cleaning of water tanks and wells, ensuring quality maintenance with expert advice from laboratories.

5.7.6.2 Long-term goal

- Implement comprehensive infrastructure upgrades, operationalise greywater treatment facilities
- Enhance infrastructure by incorporating advanced technologies, such as sensors, automatic water filling systems, and water flow meters, to effectively regulate and control water usage.
- Achieve complete campus-wide implementation of water-saving systems and reach the targeted 50% reduction in water usage by 2026 through the establishment of rainwater conservation and water recharging facilities.

5.7.7 Continuously Monitor and Enhance the System

- Registers will be priorities to systematically document water consumption data, maintenance logs, maintenance schedules, risk assessments, and water quality inspection results. Identify areas for improvement and provide essential feedback. These records will support performance tracking,

enhance accountability, and enable informed decision-making, thereby promoting continuous improvement in water management practices.

5.7.8 Conclude and Conduct Follow-Up on the System

- This Water Efficiency Plan solidifies the college's commitment to sustainable water management.
- Continuous monitoring, stakeholder engagement, and adaptive strategies will ensure risk mitigation and successful implementation
- The WMC will issue annual progress reports, conduct evaluations, and incorporate emerging technologies and best practices to refine the policy, ensuring it remains dynamic and effective.

5.8 ACTIVITES CONDUCTED

On 12th February 2025, Mar Thoma College for Women, Perumbavoor, hosted an inter departmentalPower Pointpresentation competition at the College Auditorium. The event was organized by Brainstrust of Language and Literary Club in association with the Department of Zoology and the Internal Quality Assurance Cell (IQAC) ofthe college. The theme of the competition was "Conservation of Wetlands," which is a critical environmental issue affecting ecosystems worldwide. The competition was convened by Ms. Minu Susan Koshy from the Department of English, and Dr. Jijo Jayaraj from the Department of History served as the coordinator.

The collaboration between Brainstrust of Language and Literary Club, the Department of Zoology, and IQAC ensured a comprehensive approach to the event, combining literary, scientific, and quality assurance perspectives. Nine students from different departments participated in the competition, showcasing their understanding and creativity on the theme. The presentations were evaluated based on content, delivery, and overall impact. The participants demonstrated a deep understanding of wetland ecosystems and proposed various strategies for their conservation, ranging from sustainable land use practices to community engagement initiatives.

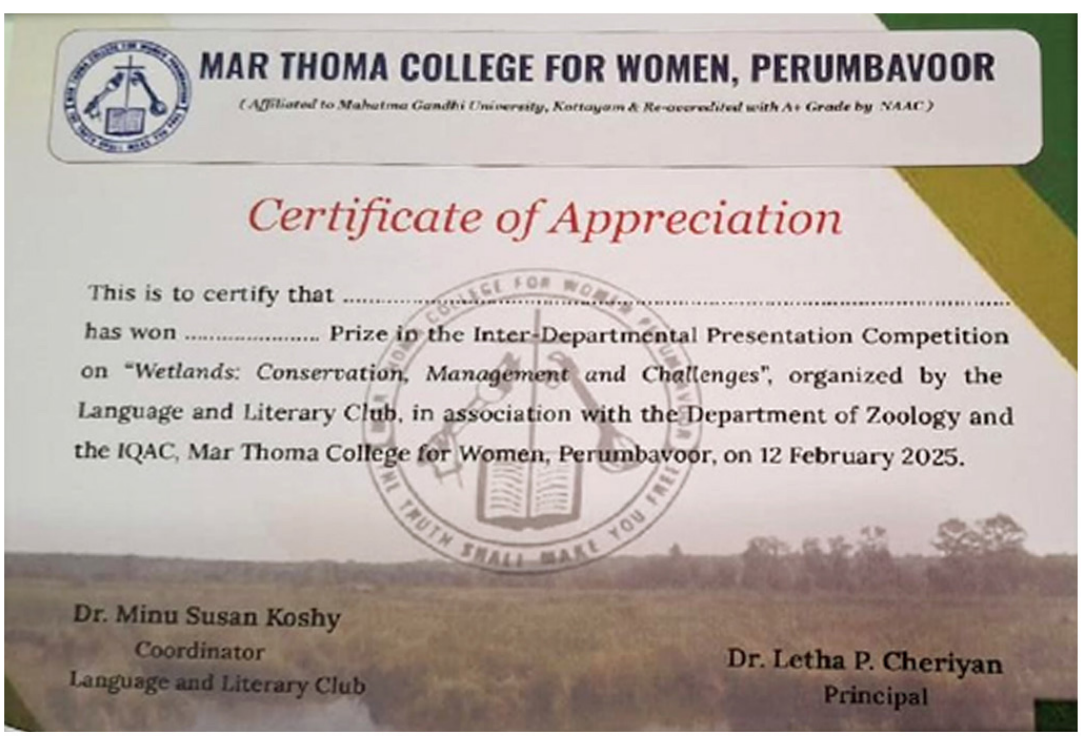
Thecompetitionwinnersare:

- **FirstPrize:** FathimaShahala ofIIM.Sc.Zoology
- **SecondPrize:** Adithya E.M.of IIB.Sc.Chemistry
- **ThirdPrize:** SnehaMohan U.P.ofIIIB.Sc.Zoology

Brochure of the Programme

Photographs of the Programme

Model Certificate



MAR THOMA COLLEGE FOR WOMEN, PERUMBAVOOR

(Affiliated to Mahatma Gandhi University, Kottayam & Re-accredited with A+ Grade by NAAC)

Certificate of Appreciation

This is to certify that .....

has won ..... Prize in the Inter-Departmental Presentation Competition on *"Wetlands: Conservation, Management and Challenges"*, organized by the Language and Literary Club, in association with the Department of Zoology and the IQAC, Mar Thoma College for Women, Perumbavoor, on 12 February 2025.

Dr. Minu Susan Koshy
Coordinator
Language and Literary Club

Dr. Letha P. Cheriyan
Principal

Chapter VI

CAMPUS BIODIVERSITY (CBR): AUDIT REPORT

TIES

MAR THOMA COLLEGE FOR WOMEN PERUMBAVOOR
THE TRUTH SHALL MAKE YOU FREE

BIODIVERSITY MANAGEMENT COMMITTEE
(BMC 2025-26)

Ms. Sunu N V
Ms. Jintumol Raj P
Ms. Keerthy Sasidharan
Ms. Jissy Thomas
Ms. Athira M
Assistant professor

Anjana Sasi
Architha R Barns
Arya P S
Aswathy David
Fathima Shabana P M
Fathima Shahala
Fathimath Noora K N
Femina K T
Naeema Parvin
Suriya K V
Alfiya Shaji
Fathima Jamal
Lakshmi Lalji
Mehrin VI
Ruxana K S
Shifa Fathima
Sona Maria Paul
Sumayya
Varshamol KB
Sandra Sunil
Students

6

Campus Biodiversity: Audit Report

6.1 INTRODUCTION

Biodiversity is crucial for supporting life and delivering essential ecosystem services, such as food production, water purification, flood and drought regulation, nutrient cycling, and climate stabilization. These functions are vital for human health and economic well-being. Biodiversity is a holistic representation of the biosphere, intricately interlinked with Earth's physical elements - soil, rocks, water, and air - all harnessed by solar energy. Over 2 to 3 billion years, a complex and stable cyclical system has emerged, enabling the flow of energy, materials, and information between living organisms and their environment. However, despite its significant ecological, economic, and cultural value, biodiversity is facing rapid decline globally, due to factors such as pollution, habitat loss, urban development, industrial activities, population growth, and unsustainable species exploitation. Habitat destruction, primarily resulting from development initiatives, alongside overharvesting of certain species for economic or recreational purposes, significantly contributes to this decline. The erosion of biodiversity disrupts ecosystems, leading to species extinction or decline and negatively impacting ecosystem functionality and food webs. This decline has extensive repercussions, including decreased agricultural productivity and reduced resilience against natural disasters like floods and droughts. Therefore, it is crucial to protect biodiversity, as its loss presents serious threats, including:

- Reduction in genetic diversity,
- Uniformity in plant and animal life

The disruption of essential ecosystem functions vital to human survival - such as providing food, medicine, timber, and air and water purification - poses a significant challenge. Ecosystem services offer a diverse range of benefits, which can be categorized into four main types: provisioning services (including food, water, timber, and genetic resources), regulating services (which encompass climate control, flood management, disease regulation, and water purification), cultural services (that pertain to recreational, aesthetic, and spiritual aspects), and supporting services (such as soil formation, pollination, and nutrient cycling). However, the demand for these services from human populations is rapidly increasing. As reported in the Millennium Ecosystem Assessment, approximately 60% of the evaluated ecosystem services - accounting for 70% of regulating and cultural services - are currently degrading or being exploited unsustainably, threatening their availability for future generations. Consequently, establishing standardised biodiversity

management systems is critical to developing principles, frameworks, requirements, guidance, and tools that provide a comprehensive, international approach for organisations, ultimately enhancing their contributions to sustainable development.

6.1.2 What is a Biodiversity Audit?

The Biodiversity Audit entails a comprehensive evaluation of the significance of biodiversity within the campus environment. Its implementation aims to establish a robust framework for future initiatives. Assessing the capacity of the campus green spaces to support essential and protected species and habitats is essential. The audit will also provide tailored recommendations to enhance and optimise biodiversity. This assessment will identify existing habitats, create habitat maps for each designated area, and evaluate the condition of various habitat types. Additionally, we will review current management practices and propose adjustments as needed to improve existing conditions. Our ultimate goal is to gauge progress in biodiversity, thereby supporting future advancements in this domain.

6.1.3 Why measure Biodiversity?

- The swift deterioration of habitats is concerning, making it imperative to evaluate their current conditions to avert potential extinctions.
- Biodiversity metrics are acknowledged as critical measures of the health of ecological systems. At present, biodiversity remains a central focus in both ecological and developmental disciplines.
- A diverse range of methods and tools is necessary for assessing biodiversity across various habitats.
- Compliance with the Convention on Biological Diversity (1992) requires the implementation of these assessments.

6.1.4 Need for Biodiversity Audit

The biodiversity audit evaluates the degree to which the college or university campus fosters wildlife habitats, encompassing plant and animal species that are not cultivated by humans. Additionally, it seeks to raise awareness and educate the campus community about the significance and benefits of biodiversity. The primary goals of the biodiversity audit include:

- Increasing awareness of the campus's biodiversity among the college community
- Promoting greenery and vibrancy
- Enhancing the visual attractiveness of the campus
- Expanding educational opportunities, both informal and formal (such as labelling trees with their names)
- Improving public health and environmental protection (ensuring clean air, water, and food)
- Serving as a valuable resource for education and public relations (e.g., through themed garden exhibits)
- Supporting community education and gathering feedback (including sharing traditional knowledge about plants and animals)

6.2 CAMPUS BIODIVERSITY MANAGEMENT POLICY

6.2.1 Statement of Commitment

Human socio-economic activities and quality of life depend on ecosystem services, including provisioning (food, water, timber), regulating (climate control, disease regulation, flood protection), and supporting (soil formation, nutrient cycling) services. Biodiversity loss is a critical global threat, with over a third of species facing extinction and 60% of ecosystems degraded in the last 50 years. Mar Thoma College integrates the role of an educational institution for the sustainable and equitable use of biodiversity and its conservation, as well as for mainstreaming biodiversity. Through assessing the status of species and ecosystems, audits can reveal potential threats like habitat loss, pollution, and climate change, allowing for targeted interventions. The information gathered through this helps to prioritize conservation efforts, develop effective management plans, and evaluate the success of conservation actions. And which can ensure that development projects and land use decisions are environmentally sound and do not negatively impact biodiversity. By documenting the importance of biodiversity and the threats it faces, it can contribute to public awareness and support for conservation efforts.

6.2.2 Goals

The main goals include the Preservation of species, ecosystem conservation, maintaining genetic diversity, promoting Community engagement in biodiversity conservation, protecting and conserving cultural heritage associated with biodiversity, such as traditional knowledge and practices.

6.2.3 Objectives

- Promote the conservation and preservation of biodiversity and natural habitats in the local community or region.
- To educate students, faculty, and staff about the biodiversity in the local environment and the critical importance of conservation.
- Active participation in the assessment can enhance awareness and cultivate a commitment to environmental stewardship.
- Conduct research projects and studies to document and monitor biodiversity in the Campus.
- Take part in restoration initiatives aimed at rehabilitating degraded ecosystems or habitats. Encourage active participation and engagement of community members in biodiversity conservation.
- Collaborate with other environmental organisations, clubs, or initiatives to leverage resources, knowledge, and collective efforts in promoting biodiversity conservation.
- Organising and attending seminars and awareness classes, conducting debates and quiz competitions

6.2.4 Resource Management

6.2.4.1 Habitat Protection and Restoration: Actively protect and restore natural habitats on campus, including gardens, green spaces, and wildlife corridors. These efforts are crucial for maintaining essential ecosystem services such as pollination, natural pest control, and nutrient cycling.

6.2.4.2 Species Conservation: The institution prioritises the conservation of all campus species and the enhancement of local ecosystems. This is achieved through the cultivation of native flora in our gardens and green spaces, with special emphasis on species of conservation concern, including rare and endangered plants and animals. To ensure the efficacy of our conservation strategies, we partner with external experts to maintain a dynamic biodiversity checklist, which serves as our primary tool for monitoring, protecting, and fostering the diversity of life on our grounds.

6.2.4.3 Butterfly Garden: The campus features a dedicated butterfly garden, which is professionally maintained by designated staff under the guidance and coordination of the campus biodiversity auditor.

6.2.4.4 Plant Conservation: To conserve flora vital to the local ecosystem, conduct an Environmental Impact Assessment (EIA) before any campus maintenance or development projects. This assessment will guide efforts to protect designated tree and fruit plant species, prevent unnecessary tree removal, and identify strategic locations for new plantings

6.2.4.5 Educational Signage: To foster environmental literacy, all significant plants are labelled with nameplates and QR codes, providing the campus community with accessible information about our diverse flora of the campus

6.2.5 Curriculum Integration

- As part of our curriculum integration, the institution has implemented an experiential learning program. Extensive field visits have enabled the development of a comprehensive Biodiversity Checklist, documenting the diverse flora and fauna within our local ecosystem.
- To promote commitment to environmental sustainability, conduct educational quiz programs and tree-planting initiatives. These interactive activities have fostered a deeper understanding of conservation among our students. Additionally, we have launched an innovative QR code system for campus trees, allowing students and staff to instantly access detailed information on each species' botanical and ecological significance.
- Organise workshops, seminars, and educational campaigns to promote awareness about the importance of biodiversity conservation among

students, staff, and the community. Encourage active participation from students and staff in citizen science projects, such as species monitoring, biodiversity surveys, and habitat restoration efforts. Build partnerships with local communities, government bodies, and conservation organisations to extend conservation initiatives beyond the campus and contribute to broader environmental preservation efforts.

6.2.6 Green Initiatives

- The Department of Zoology, in association with the Social Forestry Wing of the Kerala Forests and Wildlife Department, launched a "Vidyavanam" project in the College for the benefit of students. Using the Myawaki method, a barren piece of land was converted into a miniature forest named Vidyavanam. These forests encourage new biodiversity and an ecosystem, which in turn increases the fertility of the soil.

- The department of Zoology maintains a butterfly garden, which is specifically designed and cultivated to attract and support butterflies. These gardens are typically planted with a variety of nectar-rich flowers, host plants for caterpillars, and other elements that provide food and shelter for butterflies at various stages of their life cycle. The use of pesticides is totally avoided as they can harm both butterflies and their caterpillars. These gardens contribute to the conservation of butterfly species and also aid students in learning about biodiversity.

- Nature and Heritage club aimed to promote environmental awareness and cultural preservation through a series of interactive sessions and activities. The year resumed with an orientation on heritage and land use, highlighting human-environment interactions. A major initiative, "Mannarivu," focused on sustainable agriculture, where students received hands-on training in vegetable farming, including soil preparation, planting, and maintenance. Discussions on cultural ecology emphasised the interdependence of humans, land, and nature, while plantation drives and conservation projects contributed to environmental sustainability. These activities helped students appreciate traditional agricultural practices and the role of heritage in shaping human interactions with nature.

6.2.7 Research and Innovation

The institution prioritises research and innovation, particularly in our postgraduate programs. The MSc Zoology course, in particular, places significant emphasis on experiential learning through various projects, seminars, and webinars. Students and faculty members have a notable track record of publications, demonstrating their commitment to advancing knowledge in the field. A distinctive feature of our MSc Zoology program is the specialisation course in Environmental Science. This course provides students with in-depth knowledge and skills to address the complex environmental challenges facing our world today. Through this course, students gain a nuanced understanding of the interconnectedness of human and natural systems, as well as the skills to develop innovative solutions for sustainable development.

As an integral component of our curriculum, environmental field visits supplement our academic programs and extracurricular activities. These visits are meticulously planned to cultivate hands-on learning, research, and exploration, thereby enhancing students' critical thinking, problem-solving skills, and overall understanding of environmental concepts. In addition to academic coursework, students engage in a range of extracurricular activities that foster environmental awareness and stewardship. These initiatives include observance of special days related to environmental conservation, such as World Environment Day, Earth Day, and Wildlife Conservation Day. On these occasions, our students organize and participate in various programs, including:

- Environmental rallies and awareness campaigns

- Tree planting and afforestation drives

- Wildlife conservation and habitat restoration initiatives

- Environmental film screenings and discussions

- Expert lectures and workshops on sustainable development

These activities not only enrich our students' academic experience but also empower them to become responsible citizens and environmental leaders.

6.2.8 Purchasing and Procurement

The campus has adopted sustainable procurement practices that minimise harm to the environment and promote biodiversity conservation. Prioritise environmentally preferred products, including those certified by reputable eco-labelling organisations, made from sustainable or recycled materials, and with minimal packaging or waste. Locally sourced products, such as produce from local farmers and products manufactured locally, are also given preference. Landscape and ground maintenance practices incorporate biodiversity-friendly methods, including the use of native plant species, reducing pesticide and fertiliser use, and creating wildlife-friendly habitats. The purchase of crop plants, medicinal plants, and fruit plants that are suitable for our local climate and soil conditions promotes agro-biodiversity and supports sustainable food systems. Furthermore, procure earthworms for composting, enhancing organic waste management practices and promoting nutrient-rich soil for gardens. A supplier code of conduct is practised to emphasise environmental sustainability and biodiversity conservation. Through procurement procedures, engage with local suppliers to promote sustainable practices and monitor purchasing and procurement activities to ensure ongoing compliance with our biodiversity management policy. The procurement department, in collaboration with the campus community, continues to promote sustainable procurement practices and biodiversity conservation in our daily activities.

6.2.9 Community Engagement

Campus has fostered a strong community alien through various engagement initiatives. Regularly interact with the local panchayat and nearby companies, exploring opportunities for internships and partnerships that promote mutual growth and sustainability. Campus has also become a hub for community engagement, with visits from external agents and organisations focused on flora and fauna development, conservation, and biodiversity management. Develop a QR code system, providing easy access to information on our community engagement initiatives and biodiversity conservation efforts. Through outreach programs, raise awareness about the importance of conservation and integrate the local community. The institution is a premier destination for bird watching, offering guided tours and educational programs that highlight the area's unique avifauna. It also engages students and community members through hands-on garden maintenance, promoting practical learning and a shared sense of ownership. Agricultural practices prioritise biodiversity conservation and work closely with local stakeholders to develop and implement effective conservation strategies. By fostering these community connections, we promote a culture of sustainability, conservation, and environmental stewardship

6.2.10 Monitoring and Reporting

To ensure the effective implementation of the Biodiversity Management Policy, a structured monitoring and reporting framework. This includes mechanisms to track progress towards environmental goals, regular assessments of institutional environmental performance, evaluating the progress in updating documents/ reports, and scheduled meetings to discuss monitoring results and plan future actions. Transparency and accountability are paramount, and commit to reporting results to stakeholders in a clear and timely manner. The monitoring and reporting framework also includes the compilation of Environmental Impact Assessments (EIA) to identify potential risks and opportunities for biodiversity conservation. Furthermore, we develop and implement action plans to address any adverse environmental impacts and capitalise on opportunities for enhancement. Through this framework, demonstrate commitment to transparency, accountability, and continuous improvement in our biodiversity management practices.

6.2.11 Compliance and Review

In response to evolving biodiversity rules, regulations, and acts, our institution recognises the need for adaptable strategies to conserve biodiversity on our college campus. To ensure compliance with emerging requirements and best practices, we will:

- Regularly review and update our biodiversity policy to align with changing regulatory frameworks and international agreements.

- Develop and implement flexible conservation strategies that accommodate shifting environmental conditions and emerging biodiversity concerns.
- Foster a culture of sustainability and environmental stewardship within our campus community, promoting awareness and engagement in biodiversity conservation efforts.

The review process for our biodiversity policy will be conducted through the following ways

- Conduct regular reviews of our biodiversity policy to ensure alignment with emerging regulations and best practices.
- Solicit feedback from stakeholders, including faculty, staff, students, and external partners.
- Revise and update the policy as necessary to reflect changing requirements and conservation objectives.

6.2.12 Leadership and Accountability

Effective leadership and accountability are the cornerstones of a successful biodiversity policy. To ensure the seamless execution of our policy, established a robust framework that promotes transparency, accountability, and community engagement. Each stakeholder group within the college community has a vital role to play in maintaining biodiversity on campus. Faculty, staff, students, and administration will work together, with clear responsibilities and expectations outlined to ensure accountability.

Decisions related to biodiversity policy will be made through a collaborative and transparent process. This ensures that all stakeholders have a voice and are invested in the policy's success. Minutes of meetings and decisions will be recorded and shared with relevant stakeholders, maintaining transparency and accountability. Recognize the importance of keeping the college community informed about biodiversity policy decisions and updates. To achieve this, utilize various communication channels, including:

- Email notifications

- Campus newsletters

- Notice boards

- Community meetings and events

Regular progress reports will be submitted to the administration and relevant committees, ensuring that our biodiversity policy remains on track. To ensure the continued effectiveness of our biodiversity policy, an annual review will be conducted. This comprehensive assessment will identify areas for improvement, allowing us to refine and maintain our commitment to biodiversity conservation.

6.2.13 Conclusion

A comprehensive approach to biodiversity management is crucial for campuses seeking to promote conservation, support local ecosystems, and foster a culture of sustainability. By integrating conservation measures, sustainable practices, education, and community engagement, campuses can play a vital role in preserving biodiversity and promoting ecological health.

Campuses offer unique opportunities for research, education, and community outreach, allowing them to support local ecosystems and contribute to global biodiversity conservation efforts. Collaborative partnerships with local conservation organisations, government agencies, and community groups are essential for successful biodiversity management.

Through hands-on learning experiences and interdisciplinary research initiatives, campuses can enhance ecosystem services, mitigate environmental impacts, and cultivate environmental awareness, values, and stewardship among students, faculty, and staff. By adopting effective biodiversity management practices, campuses can serve as models for sustainability and contribute meaningfully to global efforts to preserve biodiversity.

6.3 METHODOLOGY

Integrating biodiversity conservation into its core sustainability strategy, the college has established a comprehensive plan for its preservation and enhancement. This initiative is guided by a Biodiversity Audit Team, consisting of fifty members (including eleven students and four faculty members), who are responsible for conducting thorough biodiversity assessments and overseeing internal review processes related to conservation efforts.

6.3.1 Internal Audit Training

Green audit training employs comprehensive and engaging methodologies to cultivate a sense of ownership and active participation within the institution. To prepare the college for this initiative, the Environmental Management System (EMS) selects students and faculty members for internal audit training. This one-day course certifies participants as internal auditors, equipping them to conduct water audits effectively. The internal biodiversity audit process encompasses several critical phases: evaluation, risk assessment, data collection, policy development, and the documentation of water conservation registers and initiatives.

6.3.2 Data sampling by categorising the area into different zones

Pivotal responsibilities focused on acquiring comprehensive taxonomic information through systematic and repeated field surveys. Plant data for herbs, shrubs, and trees were gathered employing random sampling techniques, spot surveys, and transect walks. Fauna data collection involved the use of transects for birds and quadrat studies for butterflies and insects.

6.3.3 Calculating the campus diversity

Quadrat sampling and transect methodologies are employed to collect data on plant and animal life, which is subsequently utilized to calculate biodiversity indices, including Simpson's Diversity Index. These measurements provide critical insights into species diversity and abundance, serving as essential indicators of the overall health of the biological community.

6.3.4 Preparing the checklist & threat and challenges to the biodiversity of the college campus

The audit team systematically identifies risks to campus biodiversity and formulates management strategies grounded in both primary data collection and a thorough analysis of secondary sources. Ongoing assessments are performed during regular meetings aimed at evaluating sustainability programs and awareness initiatives. Designated students and faculty members are responsible for documenting these activities, promoting a coordinated effort to foster a culture of sustainability on campus and to encourage its adoption within the surrounding community.

6.3.5 External Audit

An external auditor conducts an assessment to evaluate compliance with biodiversity management audit criteria and identify any discrepancies. If only minor discrepancies are found, the auditor may proceed to grant certification to the institution in accordance with the relevant ISO standards.

6.3.6 Assumption of Biodiversity audit ISO standards

The decline in global biodiversity is occurring at an unprecedented rate, significantly impacting ecosystem stability, environmental health, and human well-being. This rapid loss of species is largely driven by the rising demand for biological resources, fueled by population growth and consumption patterns.

Human societies fundamentally depend on biodiversity for critical ecosystem services. These services encompass provisioning elements such as food, freshwater, timber, and medicinal resources, as well as regulatory functions like climate moderation, air and water purification, pollination, and flood management. Furthermore, vibrant ecosystems provide vital support functions such as soil formation and nutrient cycling, along with essential cultural and aesthetic benefits. Consequently, the conservation of biodiversity is imperative for human survival and well-being.

The Biodiversity Areas Standard offers a structured approach to addressing this challenge by establishing clear, measurable criteria for the integration of biodiversity into land-use planning and management. It promotes best practices that foster resilient, self-sustaining ecosystems, enhance environmental cost-effectiveness, and mitigate the negative impacts of human development.

In alignment with global conservation goals aimed at mitigating habitat loss and land transformation, this standard highlights the significance of urban and surrounding areas. By incorporating ecological principles into all land-use decisions, we can protect and restore vital natural resources, thereby supporting a sustainable future.

6.3.7. Principles of Biodiversity Field Estimation techniques

Biodiversity estimation in the field is measuring, on the basis of three parameters:

- Species richness- No. of species: A systematic inventory of the number of species found in an area/ sample. Richness tends to increase over area. It is a measure used to find out rapid impact on the biodiversity.
- Abundance: Total number of individuals of each species in a sample/area. Represents numerical strength of each species in a community. Described as the number of individuals per sample unit (quadrate/ transect). It can be represented as biomass or percent ground cover (for terrestrial plants). Relative species abundance- represents how common or rare species is relative to other species in a given location.
- Species evenness: Defined as the relative abundance with which each species is represented in an area. When all species are equally abundant, such an ecosystem has high evenness. If some species are more abundant in an ecosystem, it has less evenness. It primarily depicts the distribution of a species in an area. Represents the relative contribution of each species to the total biomass or functioning of the ecosystems.
- Biodiversity indices: A mathematical measure of species diversity in a community- a composite value. They account species richness, abundance and evenness in varied degrees. It also provides information about the rarity and commonness of species in a community. An important tool to understand community structure.

Simpson Index D: This is an intuitively simple, appealing biodiversity index. It is the probability that two consecutive samples drawn from the same population will be different species. It involves sampling individuals from a population one at a time.

Simpson's Diversity Index is a measure of diversity which takes into account the number of species present, as well as the relative abundance of each species. As species richness and evenness increase, so diversity increases.

$$D = \sum (n / N)^2 \qquad D = \frac{\sum n(n-1)}{N(N-1)}$$

n = the total number of organisms of a particular species
N = the total number of organisms of all species

The value of D ranges between 0 and 1. With this index, 1 represents infinite diversity and 0, no diversity.

6.3.8 Stages of biodiversity audit

Biodiversity audit has the following three phases:

6.3.8.1 Pre audit phase

- Formation of audit team; scheduling audit programmes
- Setting up of scope and objectives (in tune with biodiversity conservation policy of the institution)
- Assigning each and every area of the campus (excluding interior of buildings) for specific groups of auditors

This phase includes following specific activities:

- Preliminary observations will be made by each group in their assigned area for visible organisms including plants and animals (selected fauna and flora only- see scope/ objectives)
- Scheduling the sampling dates for quadrat/ transect study.
- Preparing data entry sheets and field equipment, devices or instruments (e g., binoculars; GPS device, identification field guides etc.)

6.3.8.2 Audit phase

The following data will be recorded. Photographs of the audit process and the observations also will be taken as

much as possible in order to include in the report.

- Quadrat study for grasses, herbs, shrubs etc. All the trees will be identified and counted.
- Quadrat sampling: Sampling plots with identical measurements are laid in the study area in a random or systematic manner. The target species is searched on foot or from any vehicle within these plots. Quadrats can be of various shapes. Most common are square or rectangular. Circular quadrats are also useful since they have minimum bias related to the 'edge effect' i.e., whether a specimen is inside or outside a quadrat. The optimum number of quadrats necessary to sample a population is decided based on the rarefaction curve, which reaches a plateau if enough samplings are done. Quadrat sampling is widely used to sample vegetation.
- Transect study for butterflies, birds, dragonflies, and damselflies of the campus.

Line transect: In this method, the observer searches for the focal organisms along straight lines or transect lines, either selected randomly or laid in a systematic manner for repeated surveys. For the observations which are not on the transect line, the perpendicular distance is measured. Line transect method is useful in calculating population density when it follows the assumptions that a) No specimen on the transect line is missed, b) specimens do not move before they are sighted; in case of movement, the first detection is considered; utmost care is taken to avoid replicative observation, c) the sighting angle and the exact distance of any sighting away from the transect line, is calculated, d) each sighting is independent. For birds, mammals etc. this is a good method.

- Sign count: In case of animals, which are hard to detect, signs like fecal matter, movement tracks, scratch marks are considered. Other signs include nests or burrows.
- Point count method for birds/butterflies/dragonflies: In this method the observer stands at a specific point and counts the specimens within the circle of a certain radius. Usually the radius is determined based on the maximum distance, which can be sampled by the observer. While conducting many point count samplings in an area, the radius 64 for all should be the same to compare the data. Point count is widely used to sample bird populations. The numbers of birds seen or heard within a circle are recorded in this method.

6.3.8.3Post audit phase

- Analysis of data: species list of fauna and flora in the campus; calculation of the Simpson index for the biodiversity of the campus
- Biodiversity conservation action plan preparation (awareness and sensitisation programmes; display boards; tree naming project; planting drives; promotion of native wild and medicinal plants, etc.)

6.3.9 Work plan and Schedule of the biodiversity audit

Date	Work Plan
17/03/2025-21/03/2025	Conduct a meeting for survey participants to overview the survey areas and methodology Organising campus areas and assign students to different zones for biodiversity auditing Preparation of policy document for biodiversity auditing
24/03/2025-28/03/2035	Data collection in Zone 1 and 2 Collection of soil samples and Berlesse funnel extraction for insects Analysis of data collected from zone 1 and 2 Simpson index calculation Attend weekly meeting ,take photographs and prepare meeting minutes
01/04/2025-04/04/2025	Data collection in Zone 3 and 4 Collection of soil samples and Berlesse funnel extraction for insects Analysis of data collected from zone 3 and 4 Simpson index calculation Attend weekly meeting ,take photographs and prepare meeting minutes
07/04/2025-11/04/2025	Conduct transect study for Odonates and Butterflies Data collection Analysis of data Simpson index calculation Attend weekly meeting ,take photographs and prepare meeting minutes
21/04/2025-27/04/2025	Conduct transect study for Birds Data collection Analysis of data Simpson index calculation Attend weekly meeting ,take photographs and prepare meeting minutes
28/04/2025-30/04/2025	Conduct surveys of crops and fruit plants Conduct survey of weeds Attend weekly meeting ,take photographs and prepare meeting minutes
01/05/2025-03/05/2025	Conduct survey of medicinal plants Conduct surveys of Ornamental/climbers/trees Attend weekly meeting ,take photographs and prepare meeting minutes
05/05/2025-10/05/2025	Compile all data collected Ensure all registers and documents are completed before preparing the final report

Table 6.1 Schedule of the biodiversity management audit

Activities	Frequency	Dates of study	Mode of data collection
Quadrat & Transect sampling	Ten days Three time	07/04/2025 - 03/05/2025	Entry in the given format

Table 6.2 Workplan of of the biodiversity management audit

6.4 RESULT AND DISCUSSION

6.4.1 Checklist of flora and fauna

Checklist of Birds

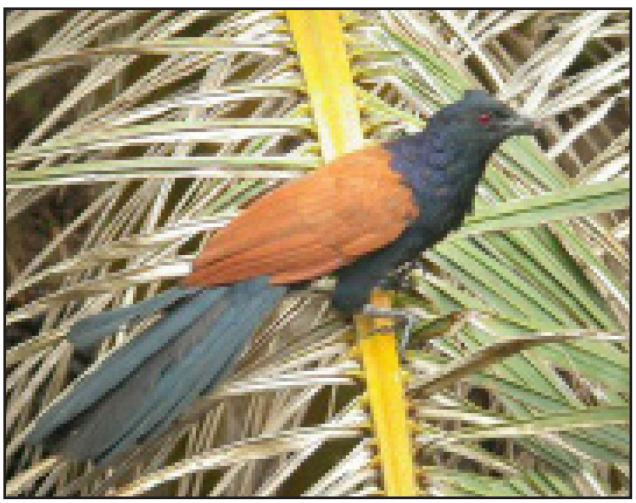
Sl No	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	COUNT
1	SHIKRA	*Accipiter badius*	പുള്ള്	1
2	COMMON MYNA	*Acridotheres tristis*	നാട്ടു മൈന	5
3	GREATER COUCAL	*Centropus sinensis*	ചെമ്പോത്ത്	16
4	ROCK PIGEON	*Columba livia*	അമ്പലപ്രാവ്	2
5	MAGPIE ROBIN	*Copsychus saularis*	മണ്ണാത്തിപ്പുള്ള്	11
6	LARGE BILLED CROW	*Corvus macrorhynchos*	ബലികാക്ക	4
7	HOUSE CROW	*Corvus splendens*	പേനകാക്ക	59
8	ROUFUS TREE PIE	*Dendrocitta vagabunda*	ഓലഞ്ഞാലി	3
9	BLACK DRONGO	*Dicrurus macrocerus*	ആനറാഞ്ചിപക്ഷി	2
10	GREATER RACKET TAILED DRONGO	*Dicrurus paradiseus*	ഇരട്ടവാലൻപക്ഷി	5
11	BLACK RUMPED FLAMEBACK	*Dinopium benghalense*	നാട്ടുമരംകൊത്തി	1
12	WHITE CHEEKED BARBET	*Psilopogon viridis*	ചിന്നകുട്ടുറുവൻ	3
13	JUNGLE BABBLER	*Turdoides striata*	കരിയിലകിളി	8
14	INDIAN POND HERON	*Ardeola grayii*	കുളക്കൊക്ക്	1
15	GREEN IMPERIAL PIGEON	*Ducula aenea*	മേനിപ്രാവ്	1
16	ASIAN KOEL	*Eudynamys scolopaceus*	കുയിൽ	3
17	WESTERN YELLOW WAGTAIL	*Motacilla flava*	മഞ്ഞവാലാട്ടി	253
18	RED WATTLED LAPWING	*Vanellus indicus*	ചെങ്കണ്ണി തിത്തിരി	5
				0.46

Table 6.3 Checklist of birds

Oriental magpie robin

White Cheeked Barbet

Rock pigeon



Greater coucal

Large-billed crow

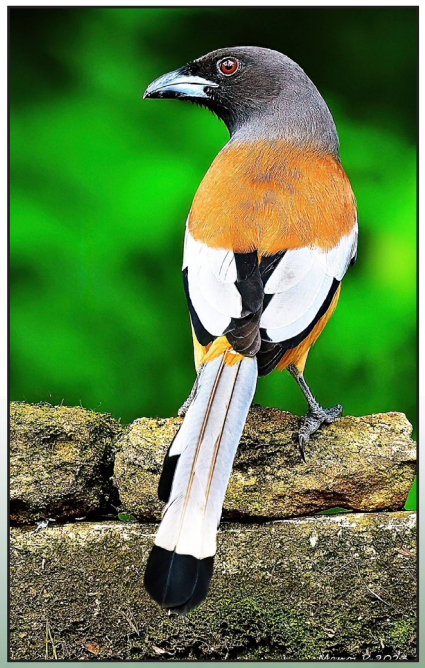
Black drongo

House-crow

Asian koel

Common myna

Black rumped flameback



Rofous tree pie

Indian pond heron

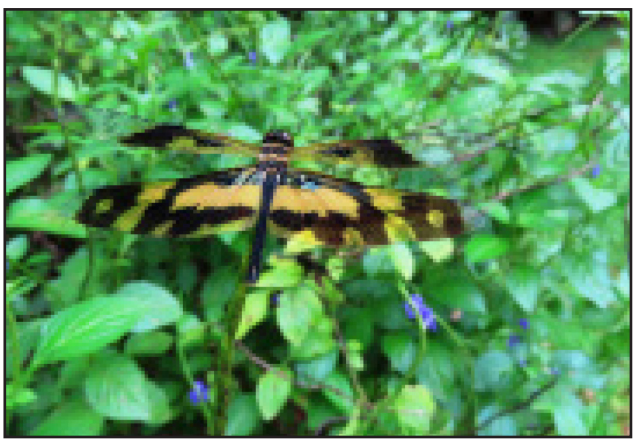
Checklist of Dragonflies

Sl.No.	COMMON NAME	SCIENTIFIC NAME	MALAYALAM NAME	COUNT
1	TRUMPET TAIL	*Acisoma panorpoides*	മകുടി വാലൻ	4
2	GRANITE GHOST	*Bradinopyga geminata*	മതിൽത്തുമ്പി	3
3	GROUND SKIMMER	*Diplacodes trivialis*	നാട്ടുനിലത്തൻ	4
4	PIED PADDY SKIMMER	*Neurothemis tullia*	സ്വാമിത്തുമ്പി	2
5	BROWN-BACKED RED MARSH	*Orthetrum chrysis*	ചെന്തവിടൻ വ്യാളി	4
6	GREEN MARSH HAWK	*Orthetrum sabina*	പച്ച വ്യാളി	2
7	COMMON PICTUREWING	*Rhyothemis variegata*	ഓണത്തുമ്പി	5
8	ASIAN DRAGON FLY	*Orthetrum glaucum*	നീലവ്യാളി	2
9	COMMON CLUBTAIL	*Ictinogomphus rapax*	നാട്ടുകടുവ	1
10	RUFOUS-BACKED MARSH HAWK	*Brachydiplax chalybea*	തവിട്ടു വെണ്ണീറാൻ	2
11	CRIMSON TAILED MARSH HAWK	*Orthetrum pruinosum*	പവിഴവാലൻ വ്യാളി	3
12	YELLOW TAILED ASHY SKIMMER	*Potamarcha congener*	പുള്ളിവാലൻ തുമ്പി	4
				0.07

Table 6.4 Checklist of Dragonflies

Orthetrum sabina

Neurothemis tullia female



Rhyothemis varigata

Acisoma panorpoides

Checklist of butterfly

Sl No	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	COUNT
1	COMMON EMIGRENT	*Catopsilia pomona*	മഞ്ഞതകരമുത്തി	5
2	PLAIN TIGER	*Danaus chrysippus*	എരുക്കുത്തപി	13
3	COMMON PALM FLY	*Elymnias hypermnestra*	ഓലക്കൻ	1
4	COMMON CROW	*Euploea core*	അരളി ശലഭം	15
5	COMMON GRASS YELLOW	*Eurema hecabe*	മഞ്ഞപാപ്പത്തി	1
6	TAILED JAY	*Graphium agamemnon*	വിറവാലൻ ശലഭം	1
7	COMMON BLUEBOTTLE BUTTERFLY	*Graphium sarpedon*	നീലകുടുക്ക	1
8	GREAT EGG FLY	*Hypolimnas bolina*	വൻചൊട്ടശലഭം	2
9	COMMON CERULEAN	*Jamides celeno*	പൊട്ടുവാലാട്ടി	5
10	YELLOW PANSY	*Junonia atlites*	പീതനീലി	8
11	CHOCOLATE PANSY	*Junonia iphita*	കരിയില ശലഭം	3
12	BLUE PANSY	*Junonia lemonias*	നീല നീലി	4
13	PSYCHE	*Leptosia nina*	പൊട്ടുവെള്ളാട്ടി	6
14	THE COMMON EVENING BROWN	*Melanitis leda*	കരിയില ശലഭം	3
15	COMMON ROSE	*Pachliopta aristolochiae*	നാട്ടുറോസ്	2
16	COMMON MORMON	*Papilio polytes*	നരകക്കാളി	2
17	BLUE TIGER	*Tirumala limniace*	നീലക്കടുവ	10
18	SOUTHERN BIRDWING	*Troides minos*	ഗരുഡശലഭം	1
19	COMMON FOUR-RING	*Ypthima huebneri*	നാല്ക്കണ്ണി	2
20	CLIPPER	*Parthenos sylvia*	ക്ലിപ്പർ	2
21	STRIPED TIGER	*Danaus genutia*	വരയൻ കടുവ	19
				0.09

Table 6.5 Checklist of Butterflies

Common cerulean

Great eggfly

Checklist of Reptiles

Sl No	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	COUNT
1	BROWN ANOLE	*Anolis sagrei*	തവിട്ടുപല്ലി	1
2	COASTAL DAY GECKO	*Cnemaspis littoralis*	നാട്ടുമരപ്പല്ലി	1
3	COMMON HOUSE LIZARD	*Hemidactylus frenatus*	പല്ലി	1
4	ORIENTAL RAT SNAKE	*Ptyas mucosa*	ചേര	1
5	ORIENTAL LIZARD	*Calotes versicolor*	ഓന്ത്	1
6	DUSSUMIERS FOREST SKINK	*Sphenomorphus dussumieri*	അരണ	1

Table 6.6 Checklist of Reptiles

Checklist of Trees

Sl No	SCIENTIFIC NAME	COMMON NAME	MALAYALAM NAME	COUNT
1	*Mangefera indica*	Mango	മാവ്	3
2	*Psidium guajava*	Guava	പേര	3
3	*syzygium jambos*	Rose Apple	ചാമ്പ	4
4	*Manilkara zapota*	Sapota	സപ്പോട്ട	2
5	*Nephelium lappaceum*	Rambuttan	റംബുട്ടാൻ	1
6	*Artocarpus heterophyllus*	Jackfruit	പ്ലാവ്	5
7	*Phyllanthus emblica*	Indian Goosberry	നെല്ലി	1
8	*Garcinia mangostana*	Mangosteen	മാങ്കോസ്റ്റീൻ	1
9	*Artocarpus hirsutus*	Wild Jack	ആഞ്ഞിലി	1
10	*Syzygium cumini*	Black plum	ഞാവൽ	2
11	*Chrysophyllum cainito*	Star apple	ചക്രപ്പഴം	1
12	*Cocos nucifera*	Coconut tree	തെങ്ങ്	14
13	*Xylia xylocarpa*	Burmese Ironwood	ഇരുൾ	2
14	*Vatica chinensis*	Malayan Teak	തേക്ക്	2
15	*Uvaria macrophylla*	Large-leaved Uvaria	കൊരപഴം	1
16	*Trema orientalis*	Charcoal Tree	ആമത്താളി	3
17	*Terminalia bellirica*	Beleric	താന്നി	1
18	*Terminalia arjuna*	Arjuna Tree	നീർമരുത്	1
19	*Sapindus trifoliatus*	Soapnut Tree	സോപ്പുംക്കായ	1
20	*Saraca asoca*	Ashoka Tree	അശോകം	2
21	*Robinia pseudoacacia*	Black Locust	ബ്ലാക്ക് ലോക്കസ്റ്റ്	1
22	*Pterocarpus marsupium*	Indian Kino Tree	വേങ്ങ	2
23	*Premna serratifolia*	Headache Tree	മുഞ്ഞ	1
24	*Pongamia pinnata*	Indian Beech	ഉങ്ങ്	2
25	*Mimusops elengi*	Spanish Cherry	ഇലഞ്ഞി	3
26	*Mammea suriga*	Surangi	സുരം പുന്ന	2
27	*Hopea parviflora*	Hopea Tree	തമ്പകം	1

28	*Garcinia gummigutta*	Malabar Tamarind	കൊടംപുളി	1
29	*Ficus racemosa*	Cluster Fig	അത്തി	1
30	*Feronia elephantum*	Wood Apple	വിളാർമരം	2
31	*Emblica officinalis*	Indian Gooseberry	നെല്ലി	1
32	*Diospyros malabarica*	Gaub Tree	പനച്ചി	2
33	*Crataeva magna*	Three-leaved Caper	നീർമാതളം	2
34	*Cinnamomum malabathram*	Malabar Cinnamon	കറുവ	1
35	*Pinanga spp.*	Pinanga Palm	കാട്ടുകമുങ്ങ്	4
36	*Cassia fistula*	Golden Shower Tree	കൊന്ന	1
37	*Bauhinia purpurea*	Purple Orchid Tree	മരമന്ദാരം	2
38	*Azadirachta indica*	Neem	വേപ്പ്	3
39	*Cyrtostachys renda*	Lipstick Palm	ചെറിയ പന	4
40	*Aphanamixis polystachya*	Pithraj Tree	ചെമ്മരം	2
41	*Annona squamosaa*	Sugar Apple	ആത്ത	1
42	*Albizia odoratissima*	Black Siris	കുന്നിവാക	2
43	*Aegle marmelos*	Bael	കൂവളം	3
44	*Couroupitia guianensis*	Cannonball Tree	നാഗലിംഗമരം	1
				0.03

Table 6.7 Checklist of Trees

Checklist of herb

Sl No	Scentific name	Common Name	Malayalam name	COUNT
1	*Oxalis corniculata*	Creepping wood sorrel	പുളിയാറില	8
2	*Mimosa pudica*	Touch-me-not	തൊട്ടാവാടി	24
3	*Phyllanthus niruri*	Stone breaker	കീഴാർനെല്ലി	38
4	*Tridax procumbens*	Coatbuttons	കുമ്മിണിപ്പച്ച	26
5	*Biophytum sensitivum*	Little tree plant	മുക്കുറ്റി	40
6	*Amaranthus viridis*	Slender amaranth	കുപ്പച്ചീര	28
7	*Acalypha indica*	Indian nettle	കുപ്പമേനി	19
8	*Tephrosia purpurea*	Wild indigo	കൊഴിഞ്ഞിൽ	16
9	*Cyanthillium cinerum*	Little iron weed	പൂവാംകുറുന്തൽ	41
10	*Panicum maximum*	Guinea grass	ഗിനിപ്പുല്ല്	46
11	*Teramnus labialis*	Horsegram creeper	കാട്ടുഴുന്ന്	19
12	*Alternanthera brasiliana*	Purple joy weed	മഞ്ഞൾ ചീര	33
13	*Clitoria ternatea*	Butterfly pea	നീലത്താമര	17
14	*Centrosema pubescens*	Wild bluepea	കാട്ടുചെറുപയർ	28
15	*Syngonium podophyllum*	Arrow headwine	സിംഗോണിയം	13
16	*Spinach oleracea*	Spinach	ചീര	53
17	*Zingiber officinate*	Ginger	ഇഞ്ചി	30
18	*Pisum sativum*	Green pea	പട്ടാണി	33

19	*Solanum lycopericum*	Tomato	തക്കാളി	11
20	*Capsicum annuum*	Chilly	മുളക്	18
21	*Solanum melongena*	Brinjal	വഴുതന	14
22	*Abelmoschus esculentus*	Lady's finger	വെ	18
23	*Coccinia grandis*	Ivy gourd	കോവക്ക	5
24	*Momordica charantia*	Bitter gourd	പാവയ്ക്ക	7
25	*Trichosanthes cucumerina*	Snake gourd	പടവലം	3
26	*Cucurbita maxima*	Pumpkin	മത്തൻ	3
27	*Achyranthes aspera*	Prickly chaff flower	കടലാടി	9
28	*Acorus calamus*	Sweet flag	വയമ്പ്	17
29	*Alpinia galanga*	Greater galangal	ചിറ്റരത്ത	5
30	*Aloe vera*	Indian aloe	കറ്റാർവാഴ	7
31	*Asparagus racemosus*	Wild asparagus	ശതാവരി	19
32	*Bacopa monnieri*	Hyssop	ബ്രഹ്മി	38
33	*Coleus aromaticus*	Indian borage	പനിക്കൂർക്ക	9
34	*Curcuma aromatica*	Wild turmeric	കസ്തൂരി മഞ്ഞൾ	13
35	*Eupatorium ayapana*	Water hemp	അയ്യപ്പാന	8
36	*Leucas aspera*	White dead nettle	തുമ്പ	18
37	*Mentha arvensis*	Field mint	പുതീന	20
38	*Ocimum gratissimum*	African basil	തുളസി	28
39	*Ophiorrhiza mungos*	Wild coffee	അവിൽപൊരി	11
40	*Piper betle*	Betel leaf	വെറ്റില	13
41	*Piper nigrum*	Black pepper	കുരുമുളക്	21
42	*Anthurium andraeanum*	Flamingo flower	ആന്തൂറിയം	6
43	*Philodendron erubescens*	Redleaf philodendron	ഫിലോഡെൻഡ്രോൺ	4
44	*Cryptanthus bromelioides*	Earth star	ക്രിപ്റ്റാന്തസ്	3
45	*Tagetes erecta*	African mariegold	ചെമല്ലി	4
46	*Caladium spp.*	Angelwings	കാലേഡിയം	8
47	*Chlorophytum comosum*	Spider plant	സ്പൈഡർ പ്ലാന്റ്	5
48	*Tradescantia spathacea*	Moses-in-the-craddle	പാതിരാപ്പൂ	9
49	*Impatiens balsamina*	Garden balsan	ചെമല്ലി	9
50	*Dieffenbachia spp.*	Dumb cane	ഡിഫൻബാക്കിയ	5
51	*Aglaonema spp.*	Chinese evergreen	അഗോണിമ	4
52	*Strobilanthes serratus*	Karini	മുറികൂട്ടി	2
53	*Barleria cristata*	Philippine violet	നീല കനകാംബരം	5
54	*Desmodium gangeticum*	Salparni	ഓരില	5
55	*Catharanthus roseus*	Madagascar periwinkle	ശവനാറി	1
56	*Cuphea hyssopifolia*	False heather	കുഫിയ	2
				0.04

Table 6.8 Checklist of Herb

Fig 6.1 Quadrat sampling

Checklist of Shrub

Sl No	Scentific name	Common Name	Malayalam Name	COUNT
1	*Calotropis gigantea*	Giant milk weed	എരുക്ക്	7
2	*Cassia occidentalis*	Coffee senna	കാട്ടുകൊന്ന	6
3	*Chromolaena odorata*	Siam weed	കമ്മ്യൂണിസ്റ്റ് പച്ച	8
4	*Lantana camara*	Wild sage	അരിപ്പൂ	9
5	*Verbesina encelioides*	Golden crown beard	വേർബേസിന	5
6	*Adhatoda beddomei*	Malabar nut	ആടലോടകം	6
7	*Baliospermum montanum*	Red physic nut	നാഗദന്തി	9
8	*Ceasalpinia sappan*	Indian redwood	പതിമുഖം	3
9	*Flueggea suffruticosa*	Shrubby fluggea	മുൾപുല്ലാനി	6
10	*Indigofera tinctoria*	True indigo	നീലയമരി	3
11	*Lawsonia inermis*	Henna	മൈലാഞ്ചി	4
12	*Plumbago indica*	Indian leadwort	വെള്ളക്കൊടുവേലി	3
13	*Rauvolfia tetraphylla*	Indian snake root	പാമ്പുംകൊല്ലി	4
14	*Ricinus communis*	Castor oil plant	ആവണക്ക്	3
15	*Bauhinia tomentosa*	Yellow bauhinia	മഞ്ഞമന്ദാരം	2
16	*Tabernaemontana divaricata*	Crape jasmine	നന്ത്യാർവട്ടം	2
17	*Rosa multiflora*	Multiflora rose	റോസ്	2
18	*Polyscias spp.*	Aralia	അറേലിയ	4
19	*Hibiscus rosa sinensis*	Chinese rose	ചെമ്പരത്തി	2
20	*Graptophyllum pictum*	Caricature plant	ഇലച്ചെടി	3

21	*Euphorbia milii*	Crown of thorns	യൂഫോർബിയ	4
22	*Clerodendrum spp.*	Bleeding heart	ക്ളിറോഡെന്ദ്രം	3
23	*Codiaeum variegatum*	Croton	ക്രോട്ടൺ	3
24	*Turraea spp.*	Turrea	മരനാരകം	2
25	*Bougainvillea glabra*	Paper flower	കടലാസ്സ് പൂ	1
26	*Duranta erecta*	Golden dewdrop	ചെമ്പഴുക്ക	2
27	*Heptapleurum arboricola*	Dwarf umbrella tree	കുടമരം	3
28	*Bougainvillea spectabilis*	Paper floiwer	കടലാസ്സ് പൂ	1
				0.04

Table 6.9 Checklist of Shrub

Checklist of Mammals

Sl No	Common Name	Scientific Name	Malayalam Name	COUNT
1	Indian flying fox	*Pteropus medius*	ഇന്ത്യൻ പഴവവ്വാൽ	1
2	Indian Grey Mongoose	*Herpestes edwardsii.*	കീരി	1
3	Indian palm squirrel	*Funambulus palmarum*	അണ്ണാൻ	1
4	bandicoot rat	*Bandicota indica*	തൊരപ്പൻ	1
5	Black rat	*rattus rattus*	കറുത്ത എലി	1

Table 6.10 Checklist of Mammals

Checklist of Moth

Sl No	Scientific Name	Common Name	COUNT
1	*Antiblemma concinnula*	Antiblemma Moth	6
2	*Asota caricae*	Tree-feeding Euteliid Moth	11
3	*Avatha discolor*	Avatha Moth	2
4	*Cyclophora pendularia*	Dingy Moth	5
5	*Dysgonia algira*	Passenger moth	2
6	*Dysgonia arcuata*	Dysgonia Moth	1
7	*Erebus ephesperis*	Erebus Moth	5
8	*Erebus hierogylphica*	Hieroglyphic Owl Moth	9
9	*Eupterote undata*	Wavy Moth	2
10	*Glycythyma chrysorycta*	Glycythyma Moth	4
11	*Hemithea aestivaria*	Common Emerald	1
12	*Hippotion rosetta*	Oblique Striped Hawkmoth	1
13	*Hypena laceratalis*	Wavy Snout Moth	3
14	*Hypenodes humidatis*	Hypenodes Moth	2

15	*Maruca vitrata*	Bean Pod Borer	3
16	*Maxates coelataria*	Maxates Moth	3
17	*Micraloa emittens*	Small Ermine Moth	8
18	*Micronia aculeata*	Micronia Moth	1
19	*Nodaria externalis*	Nodaria	1
20	*Norape ovina*	White Flannel Moth	5
21	*Nygmia icilia*	Common Yellow-wing	6
22	*Olene mendosa*	Brown Tussock Moth	3
23	*Olepa ricina*	Castor Hairy Caterpillar Moth	10
24	*Orvasca sps.*	Orvasca Moth	6
25	*Pelagodes antiquadraria*	Pelagodes Moth	5
26	*Phalacra vidhisara*	Phalacra Moth	1
27	*Scopula umbilicata*	Scopula Moth	6
28	*Simplicia bimarginata*	Two-marginal Snout Moth	2
29	*Spirama retorta*	Retorted Owl Moth	4
30	*Spoladea recurvalis*	Hawaiian Beet Webworm, Beet Webworm	3
31	*Theretra silhetensis*	Brown-banded Hunter Hawkmoth	3
32	*Trigonodes hyppasia*	Triangulate Moth	10
			0.04

Table 6.11 Checklist of Moth

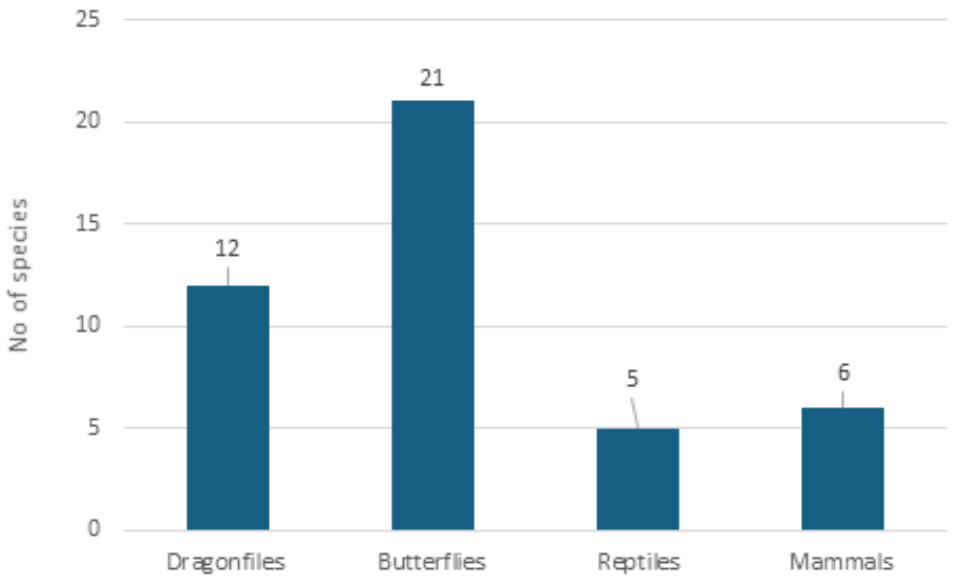


Fig 6.1 Fuanal diversity of the campus

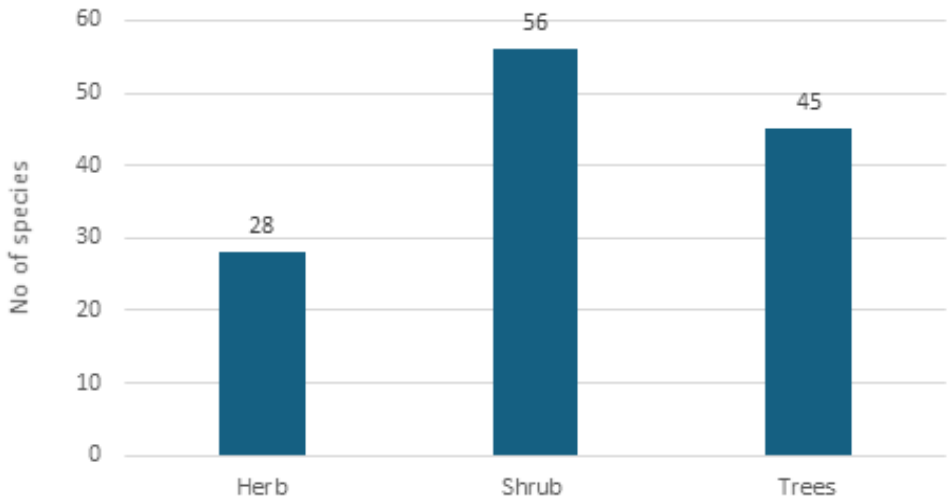


Fig. 6 .2 Flora diversity of the campus

Sl No	Table No	Funa/Flora	Abundance	Density
1	6.3	Bird	18	0.46
2	6.4	Dragonflies	12	0.07
3	6.5	Butterfly	21	0.09
4	6.6	Reptiles	6	Not applicable
5	6.7	Trees	44	0.03
6	6.8	Herb	56	0.04
7	6.9	Shrub	28	0.04
8	6.10	Mammals	5	Not applicable
9	6.11	Moth	32	0.04

Table 6.12 Summary of campus biodiversity

Fig 6.3 Internal audit evaluation meeting

Fig 6.4 Campus flora

The college campus supports moderate to low overall biodiversity, as evidenced by the surveyed taxonomic groups. The highest abundance was recorded in herbs (56 species/individuals), trees (44), moths (32), and butterflies (21). In contrast, mammals (5) and reptiles (6) exhibited the lowest counts, indicating limited representation of these vertebrates. Diversity indices (Simpson, depending on the metric used) were generally very low (0.03–0.09) across most groups, with the notable exception of birds (0.46), which is significantly higher and highlights the campus's value as a habitat for avian species.

6.5 CONCLUSION

- The college campus currently supports moderate to low overall biodiversity, as reflected by the surveyed taxonomic groups. The highest species richness and/or abundance was observed in herbs (56 species/individuals), trees (44), moths (32), and butterflies (21), whereas vertebrates were poorly represented, with only 5 mammal and 6 reptile species recorded. Diversity indices (Simpson's) were generally very low (0.03–0.09) across most groups, with birds forming a clear exception (0.46). This comparatively higher avian diversity underscores the campus's existing value as a habitat for bird species within an urban setting.
- Despite these limitations, the campus holds significant potential for biodiversity enhancement. Fertile land areas benefit from reliable irrigation supplied by the Periyar Valley Irrigation Project (sourced near Perumbavoor), creating a strong foundation for habitat restoration, native vegetation enrichment, and landscape improvement.
- The Department of Zoology is well-positioned to lead and coordinate long-term sustainability efforts on campus. Key initiatives could include strategic planting of native species, butterfly garden, development of wildlife corridors, establishment of pollinator and bird-friendly zones, and implementation of systematic biodiversity monitoring programs. With targeted, science-based conservation measures, the campus has the opportunity to evolve into a more biodiverse, ecologically resilient urban green space serving not only as an enhanced living laboratory for students and researchers, but also as an inspiring model for other educational institutions.

6.6 RECOMMENDATION

- Revamp the existing butterfly garden: thematic native pollinator haven. Replace or supplement exotics with Kerala-endemic or native nectar-

and pollen-rich flowering plants like (Evolvulus alsinoides, Leucas aspera, Didymocarpus pedicellatus. This will attract butterflies, odonates (dragonflies/damselflies), bees, and other pollinators while serving as an educational showcase of Kerala's rich insect diversity.

- Develop an integrated fruit tree and vegetable garden to explore both ecological and commercial potential. Incorporate native or well-adapted fruit trees such as mango, jackfruit, guava, amla, custard apple, or papaya, which provide food for wildlife (birds, bats, and mammals) while yielding harvestable produce. Combine these with organic vegetable beds for seasonal crops. Monitor yields to assess feasibility for small-scale sales (e.g., to local markets, school canteens, or community events), promoting food security, income generation, and awareness of sustainable agroforestry.
- Create wildlife corridors and green linkages to reconnect fragmented habitats: enabling safe species movement, gene flow, and greater ecological resilience. Link garden areas, school grounds, or nearby natural patches with hedgerows of native shrubs and trees. Enhance these with habitat features like nest boxes for birds, perches and deadwood piles for insects and reptiles, rock piles for small mammals and amphibians, and small ponds or water features to support breeding and hydration, especially vital in Kerala's monsoon-driven landscape.
- Emphasise insect- and bird-friendly native plants: Prioritise species offering nectar, pollen, fruits, or seeds, such as flowering natives for pollinators and fruiting trees like mango for frugivores. These foster food webs, trophic interactions, and ecosystem services like pollination and pest control, ultimately boosting overall faunal diversity.
- Integrate academic and student-led initiatives: linking the project to biodiversity conservation themes. Support students in conducting field observations, maintaining records of species sightings (e.g., butterflies, birds), or small research on plant-pollinator interactions. Encourage outputs like school publications (newsletters, posters, or digital reports), participation in local/national biodiversity events, or presentations at student conferences/workshops. Collaborate with programs like the Kerala State Biodiversity Board for guidance, certification, or resources, turning the project into a hands-on learning platform for environmental stewardship.

6.7 CAMPUS BIODIVERSITY MANAGEMENT PLAN

6.7.1 Establishment of a robust biodiversity management committee

- The institution formulate a Biodiversity management committee. structured and operate under the umbrella body of Management System (EMS). A dedicated committee, consisting of six faculty members and twenty-fivez students, has been appointed to oversee the cohort.
- To ensure long-term sustainability and seamless operation of biodiversity audit through implementing continuous monitoring ,
- the committee will recruit new members from the first-year student cohort each year. Regular meetings will be held to review progress, manage activities, and provide updates.
- The committee's primary mandate to cultivate a campus environment that actively prioritizes the sustainability by maintaining the diversity of flora and fauna to induce a green campus.

6.7.2 Comprehensive strategy formulation

- The principal of the college will ensure that all biodiversity-related responsibilities, conservation initiatives, curriculum integration, community outreach networking were managed and precisely communicated to the Governing Council meetings. Predicated on approval of governing council, the principal with the assurance of Treasurer and Bursar, will develop a comprehensive plan to implement these responsibilities.
- Faculties and students will be responsible of contributing biodiversity, conservation practices, advanced research possibilities, organising and coordinating sensitization programs at campus.
- To ensure that all staff members are aware of their

biodiversity-related responsibilities, specialized orientation sessions will be held exclusively for college community during the commencement of each academic year.

- Develop an experiential learning program, which includes extensive field visits to develop and update campus Biodiversity Checklist annually. This checklist documents the diverse flora and fauna within the local ecosystem, additionally providing a valuable resource for students, staff, and the community.
- Continue to protect and restore natural habitats on campus, including gardens, green spaces, and wildlife corridors. These interventions perpetuate essential ecosystem services like pollination, natural pest control, and nutrient cycling.
- Annually administer Environmental Impact Assessments (EIA) prior to the campus infrastructure management or development projects to conserve campus ecosystem. This assessment guides efforts to protect native tree and fruit plant species, moreover, alleviate the impact of unjustified deforestation, and identify suitable location for transplanting
- Enable OR encoded tree labelling to foster environmental literacy.
- Prioritizes environmentally responsible procurement, minimizing harm and promoting biodiversity conservation. adopt key practices such as purchasing environmentally preferred products, locally sourced materials, and implementing biodiversity-friendly landscape methods. Additionally, promote agro-biodiversity, utilize earthworm composting, and adhere to a supplier code of conduct emphasizing sustainability and biodiversity conservation.
- Conduct biodiversity assessments, identify areas of high conservation value and develop strategies for protection.
- Create wildlife-friendly habitats, Establish native plant species, bird-friendly habitats, and insect hotels.
- Implement integrated pest management, Use eco-friendly methods to manage pests and reduce chemical use.
- Develop a campus tree management plan, Protect and enhance the campus tree population.
- Offer workshops, lectures, and training sessions on biodiversity conservation and sustainability.
- Prioritize social media, posters, and events to raise awareness about the importance of biodiversity conservation.
- Identify teaching staff champions to integrate biodiversity into their curriculum and promote awareness.
- Appoint student ambassadors to promote biodiversity awareness and encourage participation.
- Organize events to celebrate World Environment Day, Earth Day, and other environmental awareness days.
- Organize training sessions and workshops for students, staff, and faculty on biodiversity management, conservation, and sustainability.
- Invite experts to deliver guest lectures on biodiversity-related topics.
- Organize study tours to biodiversity-rich areas, conservation sites, and sustainable development projects.

6.7.3 Objectives

- To create a comprehensive plan that conserves and enhances the biodiversity of our college campus. In the future, the college's vision is to transform the campus not only into a hub for academic excellence but also a model for sustainability and environmental stewardship. To achieve this mission, articulate strategies that promote sustainable practices, reduce our environmental footprint, and create a biodiversity-friendly campus.

6.7.4 Establishing a robust communication channel

To ensure effective biodiversity management, it's essential to establish a robust communication channel that facilitates information sharing among students, teaching staff, non-teaching staff, and management.

- Create a dedicated website for biodiversity management, featuring updates, news, and resources.
- Propagate regular newsletters to subscribers, highlighting biodiversity-related events,

achievements, and initiatives.

- Establish social media groups (e.g., WhatsApp, Facebook) for real-time communication and open discussion.
- Designate notice boards for posting biodiversity-related information, events, and announcements.
- Schedule regular meetings with stakeholders to discuss biodiversity management progress, challenges, and future action plan

6.7.5 Long Term and Short-term plans

6.7.5.1 Short-term plans

- Launch a comprehensive Biodiversity Awareness Campaign to educate and engage our community on the importance of biodiversity conservation.
- Establish a beautiful Biodiversity-themed Garden showcasing native plant species and providing a tranquil oasis for students and staff.
- Implement Sustainability Initiatives, including recycling and composting programs, to reduce our environmental footprint and promote a culture of sustainability.

6.7.5.2 Long-term plans

- Establish a Biodiversity Research Centre, a cutting-edge facility that fosters innovation, research, and discovery in biodiversity conservation. This centre will bring together experts, students, and stakeholders to advance our understanding of biodiversity and develop effective conservation strategies.
- Extend the collaboration with external agency government, and non-government for ecological restoration and sustainability
- To Achieve Carbon Neutrality by coming years. This ambitious goal requires a concerted effort to reduce our greenhouse gas emissions and transition to renewable energy sources.
- As water availability is surplus in the campus start an aquaculture pond which will promote campuse aesthetics and led to food safety and security at large.

6.7.6 Continuously monitoring and enhancing the system

- Conduct annual biodiversity assessments of campus areas and prepare detailed reports.
- Maintain and regularly update all Biodiversity Management System registers.
- Facilitate monthly meetings to review progress, follow up on action items, and clarify assigned tasks.
- Actively solicit feedback and concerns from the college community through designated communication channels (e.g., a dedicated WhatsApp group).

6.7.7 Conclude and conduct follow up on the system

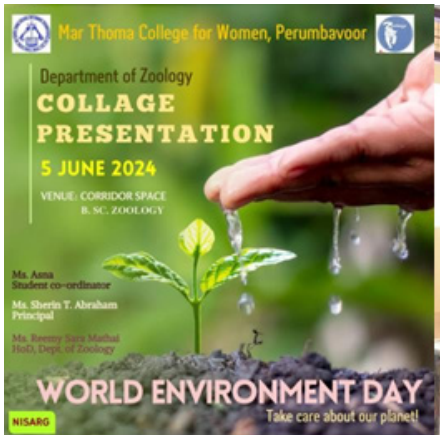
- An annual review has to be conducted by an independent external body or a designated internal team to identify areas for improvement and verify compliance with BMS regulations.
- A suggestion box can be established to allow all members of the college community to provide feedback, report concerns, or suggest improvements related to biodiversity management. The BMS committee will have to go through these monthly and take necessary actions according to the policy.\
- The BMS Coordinator communicate with the Principal, Treasurer, and Bursar to allocate a budget for the BMS. To ensure accountability and allocate adequate funds for the functioning of BMS.
- Create online feedback forms for stakeholders to provide input on biodiversity management initiatives.
- Conduct regular surveys to assess stakeholder awareness, knowledge, and attitudes towards biodiversity management.

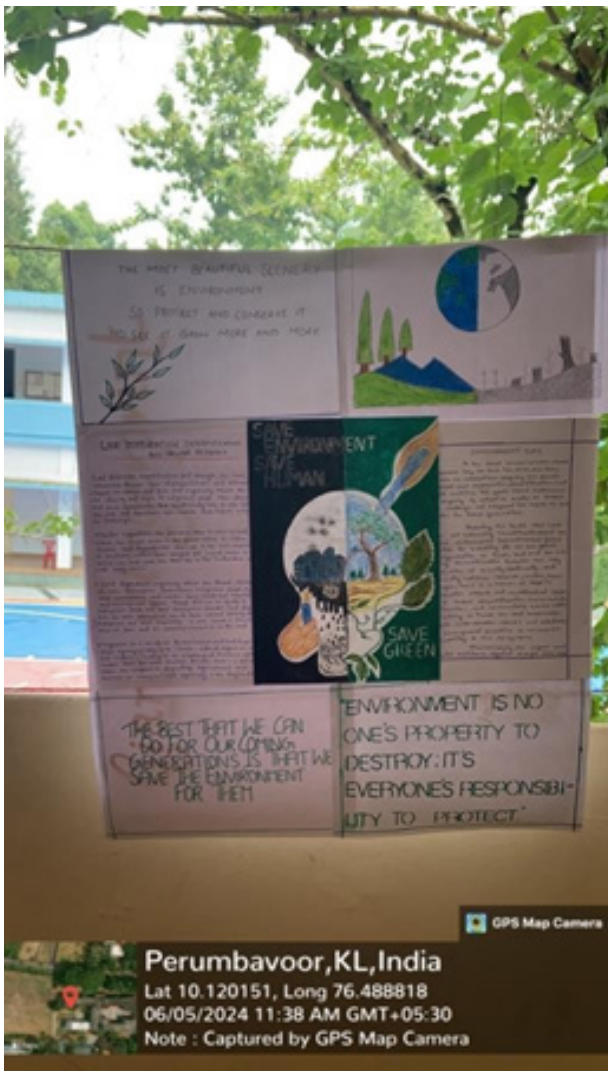
6.8 ACTIVITIES CONDUCTED

Report on Collage Presentation Department of Zoology

Highlights	
Organizer	DepartmentofZoology
Date	05/06/2024
Studentcoordinator	Ms.Asna
Objective	Tocreateanawarenesson environmentconservation
Beneficiaries	Students and staffs of Mar ThomaCollegeforWomen, Perumbavoor
Outcome	Successfully created an awarenessonenvironmental issuesandadvocacy,leaving a lasting impact for an eco-friendly future.

The Department of Zoology organised a collage presentation as part of World Environment Day celebration on 5th June, 2024 through collage that depict various elements of nature. Accompanying it are insightful write-ups and drawings that delve into environmental issues orestation,pollution,climatechange,andwildlifeextinction. Thisservedtoeducate viewers on the importance of sustainable living and the steps we can take to protect our environment for an eco-friendly future. An appreciation prize was given to third year B. Sc. Zoology student, NiveditaVelayudhan for her beautifulwork so asto motivate other students for such engagements.




SAVE GREEN
THE BEST THAT WE CAN DO FOR OUR COMING GENERATIONS IS THAT WE SAVE THE ENVIRONMENT FOR THEM
"ENVIRONMENT IS NO ONE'S PROPERTY TO DESTROY: IT'S EVERYONE'S RESPONSIBILITY TO PROTECT"
GPS Map Camera
Perumbavoor,KL,India
Lat 10.120151, Long 76.488818
06/05/2024 11:38 AM GMT+05:30
Note : Captured by GPS Map Camera

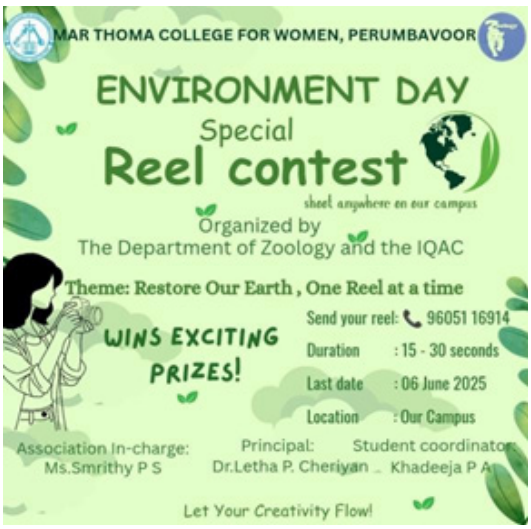

SAVE ENVIRNMET
SAVE LIFE
Solution
POLLUTION
POLLUTION
HARMFUL FOR EARTH AND
FOR U
GPS Map Camera
Perumbavoor,KL,India
Lat 10.120117, Long 76.488850
06/05/2024 11:38 AM GMT+05:30
Note : Captured by GPS Map Camera

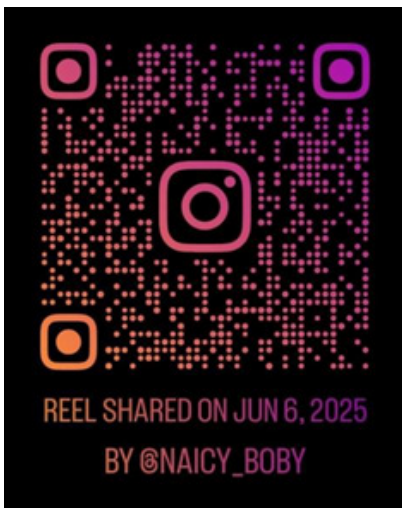

SAVE ENVIRNMET
SAVE LIFE
SAVE EARTH
GPS Map Camera
Perumbavoor,KL,India
Lat 10.120162, Long 76.488848
06/05/2024 11:37 AM GMT+05:30
Note : Captured by GPS Map Camera

Report on Reel Contest Department of Zoology

Highlights	
Organizer	DepartmentofZoology
Date	06-06-2025
Objective	To develop digital skills and showcase the beauty of campus.
Beneficiaries	Students and staff of the college
Outcome	Encouraged a sense of pride and connection with the campus environment.

AspartofWorldEnvironmentDay,theDepartmentofZoologyorganisedareelcontestonthe theme: 'Restore our Earth, One reel at a time', open to all staff and students of Mar Thoma College for Women, Perumbavoor on 6th June, 2025. It provided a platform for creative expressionwhile highlighting theaesthetic and livelyaspectsof campuslife. NaicyBabywas declaredthewinnerofthereel contestforhercaptivatingcampusvisuals.Shereceivedacash prize of Rs. 300 in recognition of her creativity and effort.





Biodiversity Management Audit
Environment Related Programs

Environmental Day Celebration

PROGRAMME	Environmental Day Programme
ORGANIZER	NSS UNIT NO:57
BENEFICIARY	STUDENTS AND STAFF
DATE AND TIME	05 JUNE 2024,09:30 AM
DURATION	FULL DAY
OBJECTIVE	PROMOTE ENVIRONMENTAL PROTECTION AND CONSERVATION
OUTCOME	SAPLINGS WERE PLANTED
NO: OF PARTICIPANTS	80

Summary

Mar Thoma College for Women Perumbavoor NSS Unit No: 57 has celebrated World Environmental Day on 05 June 2024 at 09:30 AM. This year NSS Unit has emphasized on the theme: OUR LAND OUR FUTURE. Principal Sherin.T.Abraham inaugurated the occasion by planting a sapling. Along with the Programme Officers and Volunteers, the faculty members and non-teaching staff graced the occasion with their presence .Saplings were distributed to students and faculties.

Oushadha Udhyanam

PROGRAMME	OUSHADHA UDHYANAM
ORGANISER	NSS UNIT
ASSOCIATING PARTNER	NAGARJUNA AYURVEDA
BENEFICIARY	STUDENTS OF MTCW
DATE AND TIME	23 JULY 2024,10AM
DURATION	1.5HRS
OBJECTIVE	Establish a medicinal garden for education and research purposes.
OUTCOME	Enhanced biodiversity, aesthetic appeal, and hands-on learning opportunities created.
NO: OF PARTICIPANTS	70

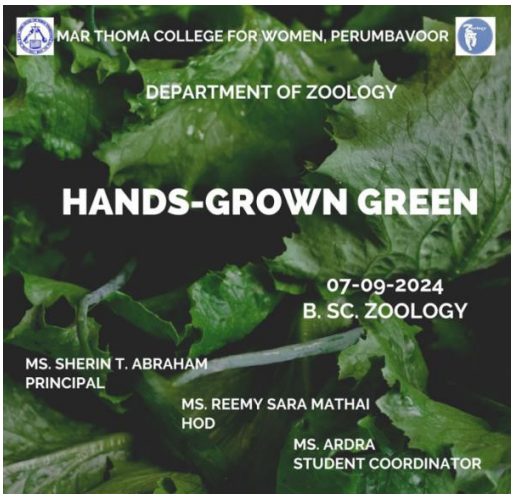
Summary

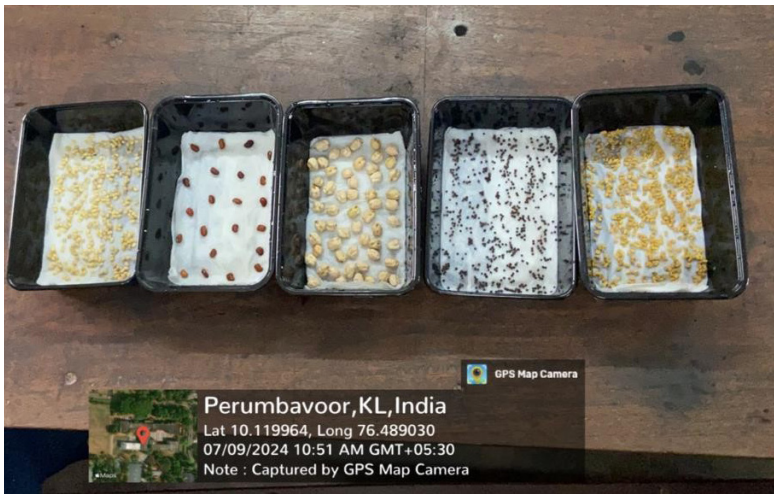
NSS Unit in association with Nagarjuna ayurveda conducted a program in which Adv. Eldhose Kunnappilly (MLA, Perumbavoor) was the Chief Guest. Our Chief Guest planted a medicinal plant in college. Later, a class was conducted in the PG Seminar hall of our college. Nagarjuna Group conducted a quiz in which many NSS volunteer prizes. Later, NSS volunteers planted medicinal plants in the garden. Overall, the program was a success.

Report on Hands-Grown Greens Department of Zoology

Highlights	
Organizer	DepartmentofZoology
Date	07/09/2024
Studentcoördinator	Ms.Ardra
Objective	Toencouragegreenpracticesamongstudents.
Beneficiaries	StudentsoftheDepartmentofZoology
Outcome	Toraiseawarenessofgreenliving,sustainable food production, and healthy eating habits.

On September 7, 2024, the Department of Zoology conducted a workshop on Microgreens ProductionnamedHands-Grown Green. It was aimed to encourage sustainable practices among students by engaging them in the cultivation of microgreens—young, edible plants packed with nutrients. The workshop aimed to foster awareness of green living, sustainable food production, and healthy eating habits.

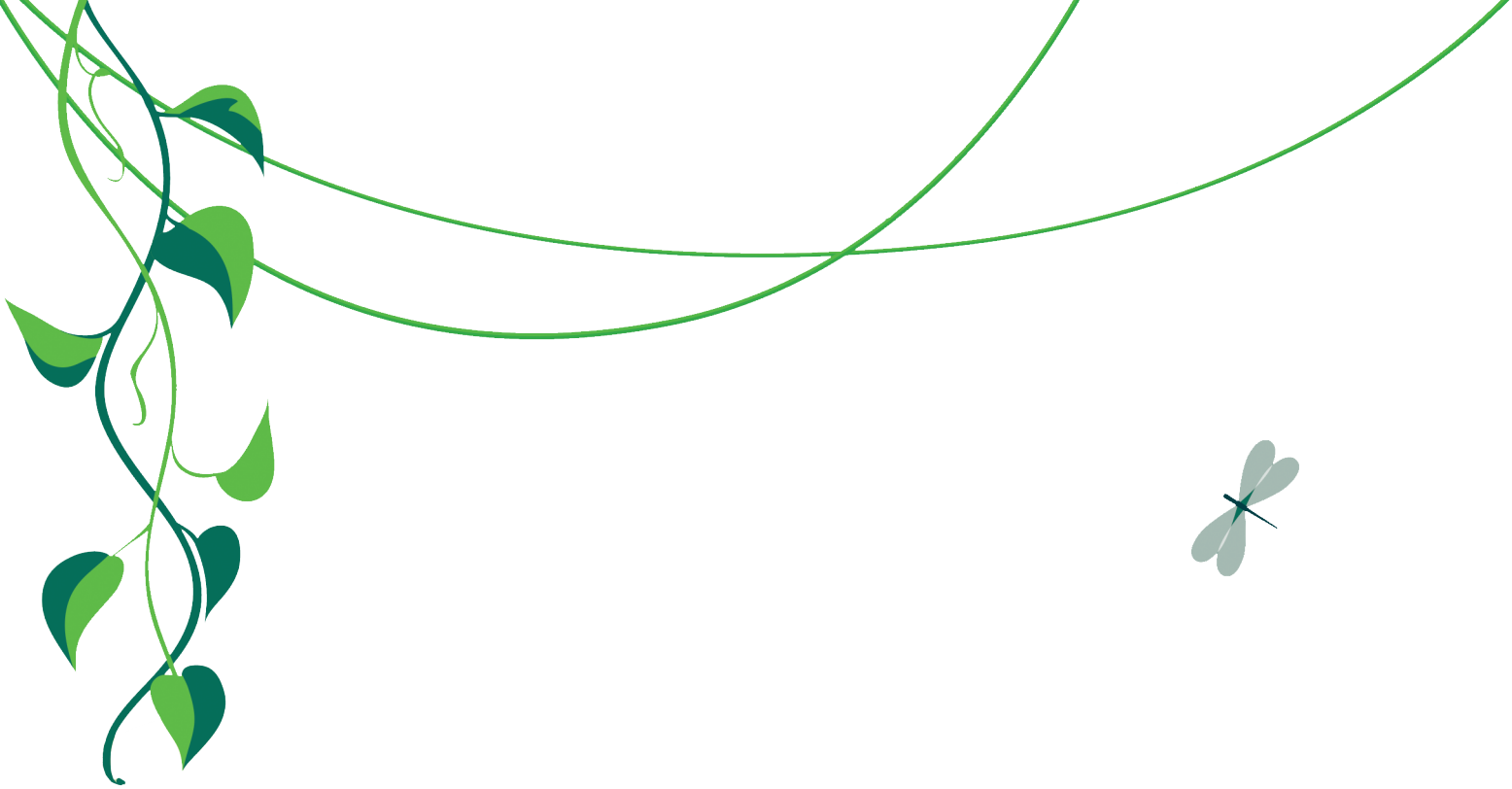




Report on Debate Competition Department of Zoology

Highlights	
Organizer	DepartmentofZoology
Date	11-07-2025
Objective	To improve public speaking, logical argumentation, and teamwork skills
Beneficiaries	Zoologystudentsofourcollege
Participants	Firstyearandsecondyear students
Outcome	Developed critical thinking via debate among students while encouraging them to explore the link between population dynamics and public health.

The Department of Zoology organised an inter-class debate competition on the theme"Will Population Growth Adversely Affect Public Health?" as part of World Population Day observance on July 11, 2025. The debate not only encouraged first year and second year students to apply classroom knowledge to real-world issues but also a commendable understanding of bothbiologicalandsocio-economicaspects related to the population and public health. The Head of the Department appreciated all participants for their enthusiastic involvement andSecond year Zoology students received special recognition for their victory



The Environment is where we all meet;
where all have mutual interest;
it is the one thing all of us share.

- Lady Bird Johnson -

Chapter VII

WASTE MANAGEMENT SYSTEM (WMS): AUDIT REPORT

WASTE MANAGEMENT COMMITTEE
(WMC 2025-26)

Dr. Jijo Jayaraj
Mr. Jiju John Y
Ms. Serene Anna Sam,
Ms. Arya M L
Dr. Vincy Vijayan
Assistant Professor

Fidha Fathima
Jissa Jinson
Kanmaya Sreeraj
Dhanasree P.R
Athulya
Gopika
Aparna
Sajira P. Sidheek
Sakhishma P.S
Fathima Farsana M.B
Anu Raveendran
Students

7

Waste Management System:Audit Report

7.1 INTRODUCTION

Solid waste management (SWM) presents a major challenge for governments and local authorities, especially in developing nations where inadequate management systems worsen social, environmental, and health issues. Annually, about 2.01 billion tons of waste are produced worldwide, with the East Asia and Pacific region alone contributing 468 million tons equivalent to the weight of 46,337 Eiffel Towers or 4.5 million blue whales. The increasing quantity and complexity of waste, stemming from modern consumption habits and economic expansion, pose significant risks to ecosystems and public health. Nearly 5% of global greenhouse gas emissions are attributed to the decomposition of organic waste. In India, which is recognized as one of the fastest-growing economies, annual waste production reaches 62 million tons; however, only 70% of this waste is collected, and just 12 million tons are treated. Consequently, 31 million tons are disposed of in landfills, leading to serious air, water, and soil contamination. Projections indicate that municipal solid waste (MSW) generation in India may rise to 165 million tons by 2030, driven by changing consumption patterns and rapid urbanisation. Key obstacles include inefficient collection systems, open and unsanitary landfills, and insufficient treatment facilities. The issue of e-waste, containing hazardous substances, is urgent and expected to escalate in both developed and developing countries.

In India, the informal sector plays a vital role in recovering value from waste. However, inefficiencies in collection, sorting, and recycling processes result in significant quantities of recyclable materials being discarded in landfills. Urban areas, home to 377 million people, generate substantial amounts of waste, but only 43 million tons are collected annually, leaving a large volume untreated. The inadequacy of infrastructure is evident, with only 21 million waste collectors compared to China's 700 million, and only 30% of waste is sorted properly.

The responsibility for solid waste management in India falls to the Union Ministry of Environment, Forests, and Climate Change, adhering to principles of "sustainable development," "precaution," and "polluter pays." The Environmental Protection Act of 1986 establishes the legal framework for waste management regulation, underscoring the duty of cities and businesses to minimise environmental damage and adopt sustainable practices. On educational campuses, Municipal Solid Waste (MSW) comprises items such as stationery, organic waste, food scraps, metals, packaging, hazardous material containers, and electronic waste. Sustainability efforts in these institutions focus on improving MSW management and initiatives for managing liquid waste through water

audits. Higher Education Institutions (HEIs) play a crucial role in advocating sustainability by merging knowledge with community involvement and advancing societal progress through research and innovation.

The ISO 14001 standard, recognised worldwide as a guideline for environmental management systems, provides a framework for establishing and maintaining effective waste management practices. This framework helps institutions lower waste, reduce environmental impacts, and improve overall efficiency. It evaluates waste management system performance, promotes responsible resource use, and identifies opportunities for improvement to ensure continuous progress in waste reduction and sustainability efforts.

7.1.1 What is Waste Management Audit?

A waste audit involves a thorough examination of all waste produced within an organisation. It provides insight into what is being discarded, the quantity, and the common contaminants generated by people. This process assesses the effectiveness of the existing waste management system and highlights opportunities for introducing new strategies.

- A detailed inventory of the different types of waste produced on the college campus from various sources, including canteens, dormitories, classrooms, offices, and laboratories.
- An extensive review of the existing waste management practices at each source, assessing their impact on the environment and the well-being of stakeholders.
- The development of an effective scientific waste management system on campus aimed at enhancing waste management practices and fostering environmental conservation, including promoting behavioural changes and the installation of facilities such as a biogas plant, composting units, and materials recovery centres.

7.1.2 Need for Waste Management Audit

The objectives of waste management and environmental policy are to educate and inform stakeholders about the importance of environmental compliance in a clean environment. This policy is applicable to all faculty and students at the college or university, fostering an eco-friendly atmosphere. The Waste Management Policy emphasizes the importance of maintaining a clean campus through proper waste disposal practices and recycling guidelines for biodegradable materials, as well as utilizing environmentally friendly products to keep the campus free from hazardous waste and pollutants (Cardenas and Halman, 2016). Initiatives aimed at raising awareness help to cultivate an eco-conscious culture among students and the local rural community. Leadership, including Department Heads and Senior Managers/Management Representatives, is tasked with overseeing the institution's waste management efforts and ensuring campus cleanliness, while all members of the organization are expected to adhere to the policy. Effective Waste Management can support the institution's green initiatives, aiding in the conservation of the planet for future generations. Additionally, conducting a Waste Management audit every three years is crucial, as it enhances understanding among students and staff regarding the significance of Waste Management and its beneficial effects on promoting the 'Go Green' initiative, which positions the institution as an environmental leader within the community. Implementing effective Waste Management is a key strategy for organisations to evaluate how they can sustain an eco-friendly campus (Kaseva and Gupta, 1996).

7.1.3. Waste Management in a College in alignment with SDGs

Effective waste management in educational institutions entails minimising, reusing, and recycling the waste produced on campus through education, proper separation, and sustainable methods. This supports the achievement of Sustainable Development Goals (SDGs) such as:

- SDG 11: Sustainable Cities and Communities
- SDG 12: Responsible Consumption and Production
- SDG 13: Climate Action

Establishing environmentally friendly waste management systems contributes to a cleaner campus and fosters a sense of environmental responsibility among students.

7.2 WASTE MANAGEMENT POLICY

7.2.1 Statement of Commitment

Mar Thoma College for Women, Perumbavoor, is firmly committed to environmental sustainability and recognizes its responsibility to implement effective waste management practices. The College acknowledges, waste management is essential for protecting our environment, conserving natural resources, and promoting the health and well-being of the campus community and the wider Perumbavoor area. The college is committed to fostering a culture that values sustainable practices and considers environmental impact in all aspects of college operations and manage waste by the principles of reduce, reuse, and recycle, while ensuring compliance with all applicable environmental regulations. This policy aligns with the United Nations Sustainable Development Goal 12: Responsible Consumption and Production.

7.2.2 Goal

To establish and maintain a comprehensive waste management system that ensures environmental sustainability, minimizes waste generation, and promotes effective resource recovery through collaborative and participatory practices.

7.2.3 Objectives

- To minimize the generation of all types of waste within the campus.
- To raise awareness about the importance of scientific waste segregation at the source.
- To educate students, faculty, non-teaching staff, and housekeeping staff to practice scientific waste disposal.
- To follow the 5 R's of waste management - Refuse, Reduce, Reuse, Repurpose, and Recycle.

7.2.4 Resource Management System

The college has adopted an integrated resource management system to ensure efficient and sustainable waste handling. Color-coded bins are strategically placed across campus to facilitate effective segregation of waste into biodegradable, non-biodegradable, and recyclable categories. Composting units have been established to manage biodegradable waste and convert it into nutrient-rich compost for use in campus gardens. Dedicated drop-off points for e-waste and batteries have been set up to promote the responsible disposal of hazardous materials. Additionally, the institution has formal agreements with municipal authorities and authorized private agencies for the timely collection, transportation, recycling, and disposal of all types of waste.

7.2.5 Curriculum Integration

The institution integrates waste management and sustainability into its curricular and co-curricular framework. Regular awareness campaigns, competitions, and exhibitions are organized to educate the campus community on scientific waste management. Guidelines have been issued for conducting zero-waste events on campus. Student organizations such as the NSS, NCC, and Nature and Heritage Club actively lead various sustainability initiatives with the support WMS committee. Administrative departments have adopted a paperless approach where feasible, supported by digital systems. Best practices and successful innovations are documented and shared with other academic institutions. Student-led clubs and initiatives focusing on sustainability are encouraged and supported through mentorship and resources. Organising orientation programs for new students and frequent staff workshops or training sessions are the first steps in raising awareness. These programs highlight the significance of waste reduction, reuse, segregation, and appropriate disposal techniques. Every day, visual aids like infographics, posters, and signboards next to trash cans serve to reinforce proper procedures. Quiz contests, green week events, and eco-friendly challenges are examples of interactive campaigns that encourage students to actively engage with the issue and make learning enjoyable and memorable. Incorporating environmental themes into the curriculum whenever feasible, supporting student-led sustainability research and projects, and encouraging involvement in the college's Eco Club are further educational initiatives. Students can turn knowledge into action by taking the lead in community outreach initiatives, surveys, and awareness campaigns. Staff and faculty are informed about the institutional policies and best practices through regular seminars and practical training sessions.

This guarantees consistent comprehension and adherence across departments. The college can achieve a sustainable and waste-responsible future by fostering a culture of awareness and lifelong environmental learning.

7.2.5 Green Initiatives

As part of its dedication to waste reduction and environmental sustainability, the college has implemented several green initiatives.

- The plastic-free campus policy, which forbids the use of single-use plastics in administrative and academic settings and encourages the use of cloth bags, metal utensils, and reusable containers, is a significant initiative.
- The college utilizes eco-labelling to recognize departments that adopt eco-friendly practices and conducts periodic green audits to assess and enhance departmental contributions to sustainability. Regular campus greening and tree-planting drives are conducted to enhance biodiversity, improve air quality, and create a calm and healthy learning environment.
- To manage biodegradable waste from the campus and create nutrient-rich compost for the campus gardens (vegetables and crops), a composting unit has been installed.
- To promote the use of reusable water bottles and discourage the use of single-use plastic, for the accessibility of drinking water bottle refill stations have also been installed.

Through these initiatives, promote environmental consciousness and advance the goal of a sustainable, waste-free campus.

7.2.6 Sustainable Purchasing and Procurement

The college prioritizes the procurement of eco-friendly, biodegradable, and recyclable products. Departments are required to submit procurement plans that reflect sustainable choices. Periodic internal assessments are conducted by the IQAC to evaluate the environmental impact and optimize resource consumption.

Green procurement protocols are implemented at the beginning of each academic year, detailing purchasing norms such as bulk buying to reduce packaging waste and preferring vendors who follow local ethical vendors. Departments implement significant waste reduction through sustainable purchases, incentivized through green credits and recognition programs.

Local procurement is encouraged to reduce the carbon footprint and support the regional economy. The institution also explores partnerships with local cooperatives and recycling groups to build a circular waste economy and create financial support mechanisms for community-led sustainability initiatives.

7.2.7 Research and Innovation

The college actively supports research and innovation in waste management. Faculty and students are encouraged to undertake action research projects addressing issues like solid waste recovery, plastic alternatives, and grey water reuse. Innovation in areas such as smart bins, low-cost recycling, and waste tracking is promoted through collaborations with industries and external research bodies.

Pilot projects and demonstration units showcasing best practices in waste minimization and processing are developed on campus. These serve as practical learning modules and are monitored by the research committee and the Green Protocol Committee.

7.2.8 Community Engagement

Students actively participate in community clean-up and restoration programs in collaboration with the Perumbavoor Municipal Corporation and Suchitwa Mission. Notable practices include organizing joint awareness campaigns on plastic-free living and source segregation.

The college conducts expert-led workshops and alumni sessions on circular economy practices, upcycling, and sustainability. Participation in rallies, eco-fairs, and local environmental drives helps extend the campus's environmental responsibility to the broader community.

These efforts have led to increased environmental awareness in the surrounding communities, visible in the form of cleaner surroundings and better waste segregation practices adopted by nearby households and shops.

7.2.9 Monitoring and Evaluation

Waste audits are executed every three months to assess the effectiveness of waste segregation, aiming to prevent the mixing of different types of waste and decrease contamination levels. Monthly data is gathered to measure the amount of waste produced; if the rate rises beyond an established threshold, a feasible plan will be introduced that aligns with the college's financial requirements. Simultaneously, consider the strategies developed by other organizations to execute such initiatives, incorporating any necessary modifications and adjustments.

Detailed records of waste generation, collection, and disposal are maintained and submitted to regulatory authorities. Periodic sustainability reports are presented to the college administration and displayed on the notice board for public access.

A uniform checklist is implemented to document the various types and amounts of waste produced by different departments. The amount is determined by weighing the samples gathered during the auditing process.

7.2.10 Leadership and Accountability

The Internal Quality Assurance Cell (IQAC) shall be the nodal body overseeing the implementation of the waste management policy. Each department shall designate a Green Coordinator responsible for ensuring adherence to waste guidelines. Training programs and review meetings will be conducted regularly to reinforce accountability, assess challenges, and promote ownership of environmental practices.

7.2.11 Compliance and Review

The policy of the institution shall be reviewed annually and may be amended as required to ensure continued relevance and effectiveness. Stakeholders may submit proposals for improvement to the IQAC. Proposed changes will be reviewed and forwarded to the college management for final approval. All approved amendments will be incorporated into the policy and communicated to stakeholders.

7.2.12 Conclusion

Mar Thoma College Perumbavoor is focused on an inclusive and collaborative approach that ensures that the college's waste management practices remain dynamic, transparent, and aligned with evolving environmental needs. Through organized waste management efforts, the institution seeks to greatly minimize waste, improve recycling initiatives, and foster a culture of environmental responsibility. By involving students, faculty, and the wider community, this policy will aid in creating a cleaner and more sustainable future. With committed leadership, active engagement from all stakeholders, and continual assessment of the policy.

7.3 METHODOLOGY

Proper waste management is essential for upholding tidy surroundings, diminishing pollution, preserving resources, and safeguarding public health. An established Waste Management Group, consisting of 15 members (including 11 student representatives and 4 faculty members), oversees these initiatives according to a detailed policy. This policy delineates specific goals, action plans, and strategies, which are consistently evaluated and improved during group meetings to guarantee maximum effectiveness.

7.3.1 Data sampling and categorisation of waste

The annual waste management audit evaluates the generation of different types of waste, including food waste, plastics, litter, and electronic waste. Individual records are kept for each waste category, noting the amounts produced in key locations like the canteen and throughout the campus. Collected waste is sorted and organized into six separate streams: (1) Plastic and Paper, (2) Bio-waste, (3) E-waste, (4) Chemical Waste (Chemical samples, stain, dye, cultured media contaminated substance) and (5) Other Waste (Mat, glass wares cutleries, desk chair, bench instruments) which includes items such as broken glass, construction debris, textiles, packaging, and office supplies. Analysing the gathered data offers important insights into the annual waste generation trends on campus, differentiating between times such as regular working days, holidays, and semi-holidays.

7.3.2 Registers and Documents to monitor the process

Detailed records of waste disposal are kept, monitoring the amounts sent to recycling centres, composting sites,

and other disposal methods. Student representatives are responsible for overseeing the documentation linked to recycling centres and waste processing facilities.

7.3.3 Internal Audit Training

Green audit training promotes a sense of ownership and involvement within the institution by utilizing thorough, participatory methods. To prepare the college for this endeavor, the existing Environmental Management System (EMS) chooses students and faculty to participate in internal audit training. This one-day course certifies participants as internal auditors, enabling them to carry out a waste audit. The internal water audit process consists of several crucial phases: evaluation, risk assessment, data gathering, policy development, and the creation of registers and initiatives for water conservation and resource management.

7.3.4 External Audit

External auditors come to the college to assess compliance with waste management audit standards and pinpoint any discrepancies. Should only minor discrepancies be identified, the external auditor may grant the institution certification in line with applicable ISO standards.

7.3.5 Assumption

The generation of waste presents an increasing challenge at global, regional, and local levels. Traditional waste management techniques, such as incineration and landfilling, often lead to negative environmental effects through emissions and contaminations of soil, air, and water, which contribute to pollution and damage to ecosystems. These issues are exacerbated by unsustainable production and consumption models alongside rapid global urbanization. The significant financial resources required for effective and environmentally friendly waste management may be seen as a barrier, encouraging inadequate disposal methods that threaten both human health and environmental integrity. On a worldwide scale, waste management practices vary greatly: developed nations, particularly those in the OECD, usually maintain strong management systems, while non-OECD countries often struggle with dependence on unregulated landfills and insufficient waste sorting systems. In many countries, waste management policies still tend to support incineration or landfilling, a trend often reinforced by industrial growth. Conversely, the last few decades have seen the emergence of 'Integrated Waste Management.' This approach, guided by the principles of the Waste Hierarchy and in alignment with standards like ISO 14001, emphasizes prevention, reuse, recycling, and recovery over disposal, thus creating a more sustainable and environmentally responsible method for handling waste.

7.3.6 Stages of Waste Management Audit

Waste Management audit has three phases: Pre audit, audit and post audit.

7.3.6.1. Pre audit phase

- Formation of audit team; scheduling audit programmes
- Setting up of scope and objectives (in tune with waste management policy of the institution)
- Discusses with the responsible persons of each location (staff, teachers, lab assistants, sweepers, watchmen, students etc.) about the waste generation pattern, and provisions of their management.
- Preparation of inventory for quantity of various types of solid waste generation (location wise): MSW (general- litter, paper, stationary waste etc.); bio-wastes (food, plant litter etc.); plastic waste; hazardous waste (chemical residue from labs; discarded e wastes etc.); construction and demolition wastes; biomedical waste (e.g., from life science laboratories); e wastes (computers, CDs, pen drives, mobile phones etc.).
- Documentation of all existing practices and provisions of solid waste management in the campus

7.3.6.2. Audit phase

Auditors collect all data collected to ensure that nothing is overlooked completely in the audit. The following information has been collected during the audit phase:

- Assessment of collected data in relation with environmental policy and waste management policy of the college/university
- Review of present waste management systems and enhancement suggestions

7.3.6.3. Post audit phase

- The plan of action for the post-audit phase implementation and follow-up. All possible suggestions for the improvement of WMS of the institution is implemented.
- WMS committee will ensure that the Waste Management System is functional at expected level and the college is participating, by making the entire college/university community well informed through regular communications, monitoring through periodical evaluation programmes etc.

7.3.7 Steps of Waste Management Audit

7.3.7.1. Site assessment

Collection of contour map and campus diagram; mark the waste generation points and storage points in the diagram.

- Walk through survey; quantification process of each kind of waste at each location;
- Survey on existing waste management practices in the campus. Data on quantity and type of processing of each kind of waste is recorded

7.3.7.2. Data analysis

- Analysis of current and past performance (pre audit and post audit performances, previous audit data etc.)
- Regression analysis involves the comparison of waste production on the Y axis versus the potential waste management driver on the X axis (weather, working days/holidays etc.).
- Carbon credit calculation

7.3.7. 3. Final audit by external audit team

- Data verification- identifying non conformities
- Action plan –long tern and short term
- Final report & certification as per ISO standards.

7.3.8 work plan and Schedule of the waste audit

Week	Weekly Work Plan
18-03-25 to 14-03-2025	A meeting was conducted to outline the team's objectives and develop a plan of action for gathering data on waste management practices. Each team member was requested to review the manual in order to assist in creating the action plan. The college campus map was gathered, which is divided into different blocks, with each group assigned to a specific block for the survey. The internal audit team is split into three groups. Each group will identify and communicate with housekeeping staff from their respective blocks to gain insight into current practices. Data sheets were distributed, and each group is expected to begin data collection the following week.
14-06-25 to 28-06-25	Identify major waste sources (cafeteria, classrooms, hostels, offices) Each group is asked to understand current waste handling procedure in their assigned area

28-06-25 to 19-07-2025	Monitor the segregation of waste into categories such as organic, recyclables, and hazardous materials. Each team will be tasked with setting up registers in areas that produce the most waste daily, such as the canteen and hostel, to streamline data collection. Teams should also identify the various waste management systems in their designated areas, including biogas plants, incinerators, and dumping grounds. Record any non-functional machinery. Finally, teams are responsible for gathering information on the disposal of materials, like paper and plastic, that are sent to external organisations.
19 -07-25 to 9-08-25	Familiarize yourself with the existing waste management practices and their associated challenges. Monitor how often waste is disposed of and identify areas where regulations are not being followed. Make sure that all records and paperwork are properly filled out.

Table 7.1. Schedule of waste management audit

Activities	Frequency	Dates of study	Mode of data collection
Recording waste generation and collection food waste, plastic, litter, and e-waste) OR manual one time evaluation	Three-week, one time a day of sampling	Three working day ; 18-03-25 19-03-25, 20-03-25 Semi holidays (25-03-25, 26-03-25, 27-03-25 Holiday (30-3-25, 06-04-25, 13-04-25	Entry in the given format

Table 7.2. Work plan of the waste management audit

7.4 RESULT AND DISCUSSION

7.4.1 Analysis of waste generation and quantities

Bio-waste		
Sampling day	Average waste per day	Average per year (Kg)
Working day	3.05	610.13 ± 100.41
Semi holiday	1.54	146.11± 7.50
Holiday	0.53	40±5.73

Table 7.3 Hostel bio-waste quantity

A significant increase in bio-waste generation is observed during the college functioning period, a trend directly attributable to the college's full operational capacity and peak occupancy in the student hostels. Furthermore, the hostel's location on campus results in students taking their lunch at their residences, thereby concentrating a substantial volume of food waste in this specific area.

Plastic -waste		
Sampling day	Average waste per day	Average per year (Kg)
Working day	821.67	164.33±71.65
Semi holiday	833.33	79.17±10.98
Holiday	256.67	17.97±3.59

Table 7.4 Hostel plastic -waste quantity

Fig 7.1 data collection in hostel

The quantity of plastic waste is highest on working days, followed by semi-holidays and Sundays. This correlation suggests that plastic waste generation is proportional to student occupancy and activity within the college and its hostels. Weekends, when many students leave the campus, see a significant reduction in waste

Paper -waste		
Sampling day	Average waste per day	Average per year (Kg)
Working day	550.00	110.00± 19.67
Semi holiday	225.00	21.38± 2.38
Holiday	113.33	7.93± 1.76

Table 7.5 Hostel paper -waste quantity

Increased paper waste on working days is directly proportional to the college's normal functioning. This is caused by utilising food packaging, parcels, and stationery, and the amount of waste is limited during semi-holidays and holidays because students are absent from the hostel.

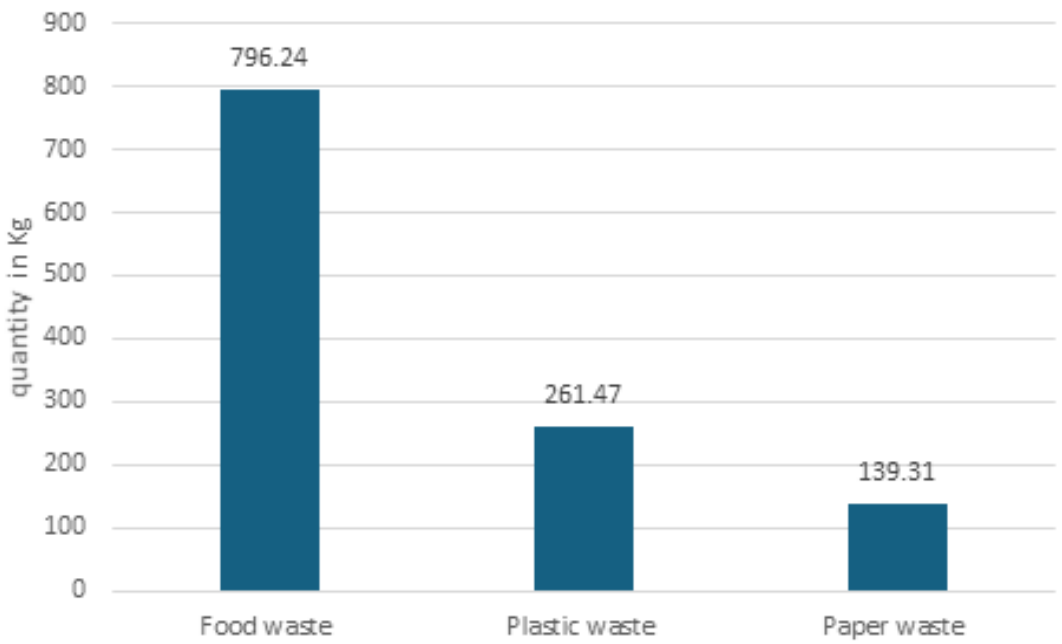


Fig 7.1 Total quantity of waste generated college hostel (Kg)

Food waste in college hostels often exceeds the waste from plastic and paper for several reasons. Sharing meals in hostels can lead to overproduction of meals, resulting in large quantities of uneaten food being discarded. he fast-paced lifestyle of college students often results in poor meal planning and buying more food than they can eat, adding to the waste. many students lack awareness of proper food storage techniques or the impact of food waste on the environment, leading to more frequent spoilage and disposal. Unlike plastic and paper, which can be easily recycled or reused, food waste usually goes to landfills, where it breaks down and produces methane, a harmful greenhouse gas. Therefore, reducing food waste in hostels needs changes in behaviour and education, making it an important issue that needs immediate focus.

Bio-waste		
Sampling day	Average waste per day (Kg)	Average per year(Kg)
Working day	0.44	88.00± 2.57
Semi holiday	0.74	38.73± 25.16
Holiday	0	0.00

Table 7.6 College office bio -waste quantity

The volume of bio-waste generated at the college fluctuates based on the daily activities of the campus community. On regular working days, waste generation is substantial due to the full functioning of the college. During semi-holidays, waste generation decreases considerably as only a few office assistants are present. It's noteworthy that no waste is typically observed on Sundays, suggesting that waste from Saturday is fully removed by the end of the day.

Paper -waste		
Sampling day	Average waste per day (Kg)	Average per year (Kg)
Working day	121.67	24.33±17.62
Semi holiday	194.67	18.49±12.64
Holiday	0	0

Table 7.7 College office paper-waste quantity

Substantial paper waste is noted during weekdays, followed by semi-holidays. In the workplace, the usage of paper documents and office stationery varies according to requirements. However, organisations have increased their use of digital communication, the necessity for hard copies and their management remains unavoidable.

Fig 7.2 data collection

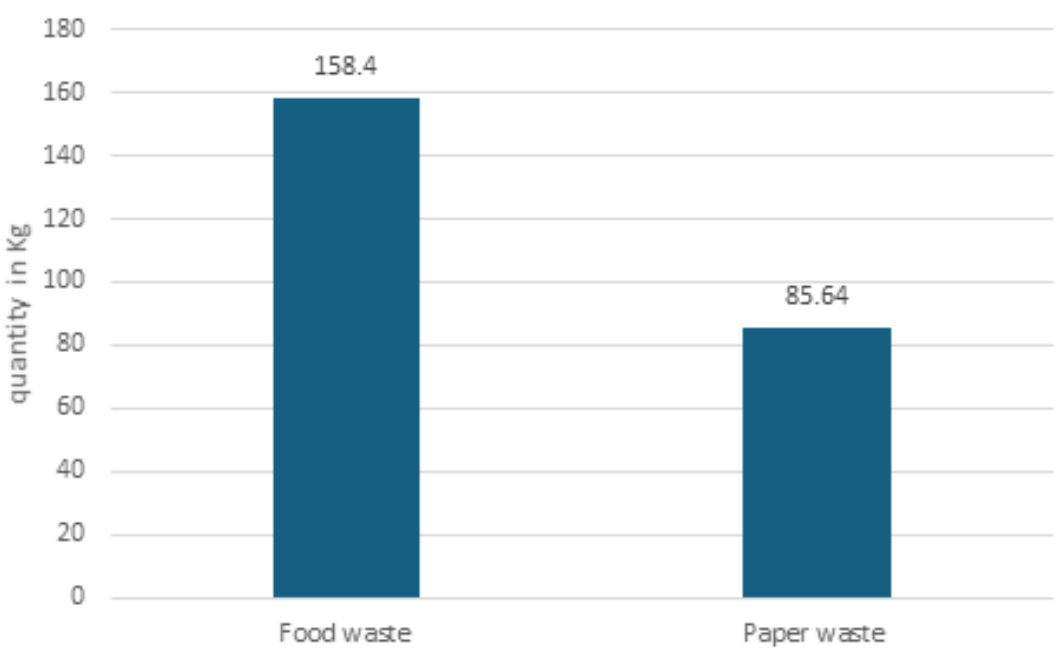


Fig 7.3 Total quantity of waste generated college office

Food waste in college settings often exceeds that of paper waste, stemming from student behaviours and dining practices. Inadequate meal planning and portion control often result in students purchasing or bringing more food than they can consume before it spoils. Additionally, the transient lifestyle of college students, combined with a limited awareness of the environmental implications of food waste, exacerbates the problem. Consequently, tackling food waste necessitates the implementation of targeted educational initiatives and behavioural modifications among students, identifying it as a crucial area for intervention to reduce overall waste in college environments.

Bio-waste (Kg)		
Sampling day	Average waste per day	Average per year
Working day	1.35	269.33± 158.71
Semi holiday	0.13	12.10± 20.95
Holiday	0.00	0.00

Table 7.8 College campus bio-waste quantity

During regular working days, a considerable amount of waste is generated, particularly food waste from classrooms, departments, and events associated with college activities. Conversely, on semi-holidays, the volume of food waste tends to be significantly lower, as it is primarily limited to specific departments involved in college events.

Paper-waste (Kg)		
Sampling day	Average waste per day	Average per year
Working day	0.45	89.67±36.61
Semi holiday	0.55	52.22±52.44
Holiday	0.00	0.00

Table 7.9 College campus paper-waste quantity

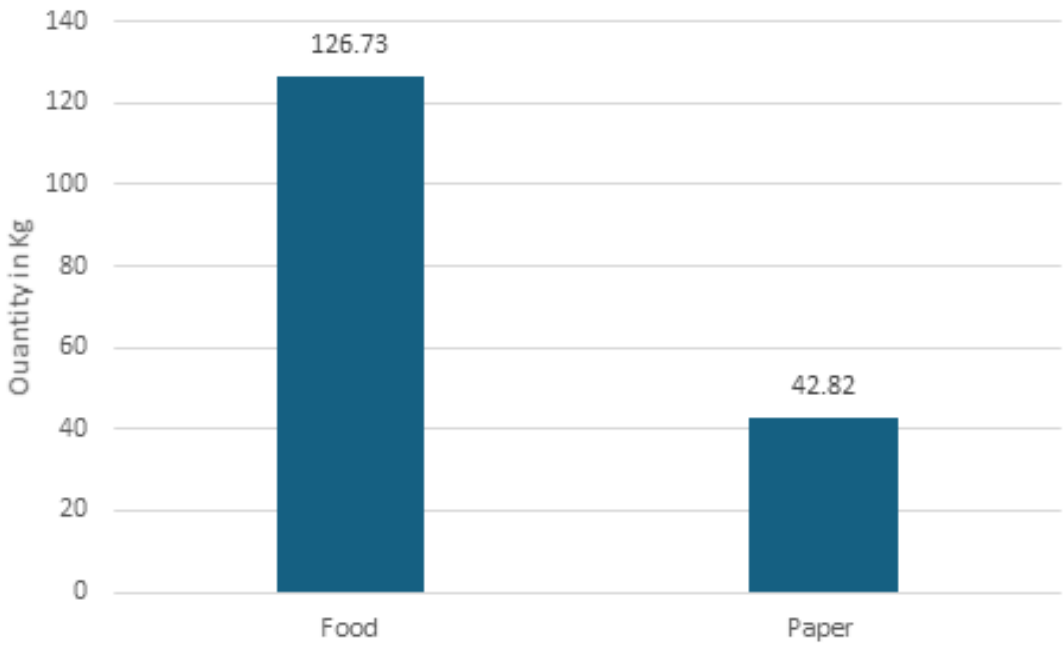


Fig 7.4 Total quantity of waste generated college campus

Food waste on college campuses frequently surpasses paper waste, largely attributable to the dining choices and habits of the college community. Moreover, a limited understanding of the environmental consequences of food waste further compounds the issue. Therefore, to effectively tackle food waste, it is essential to implement targeted educational initiatives and promote behavioural changes among students, highlighting the importance of this issue as a critical area for intervention aimed at reducing overall waste in these settings.

Fig 7.3 Bottle both

Bio-waste (Kg)		
Sampling day	Average waste per day	Average per year
Working day	3.88	775.33± 329.42
Semi holiday	1.76	166.85± 329.42
Holiday	0.00	0.00

Table 7.10 Canteen bio-waste quantity

Plastic -waste (Kg)		
Sampling day	Average waste per day	Average per year
Working day	1.47	294.00±21.28
Semi holiday	1.95	184.84±161.21
Holiday	0	0

Table 7.11 Canteen plastic -waste quantity

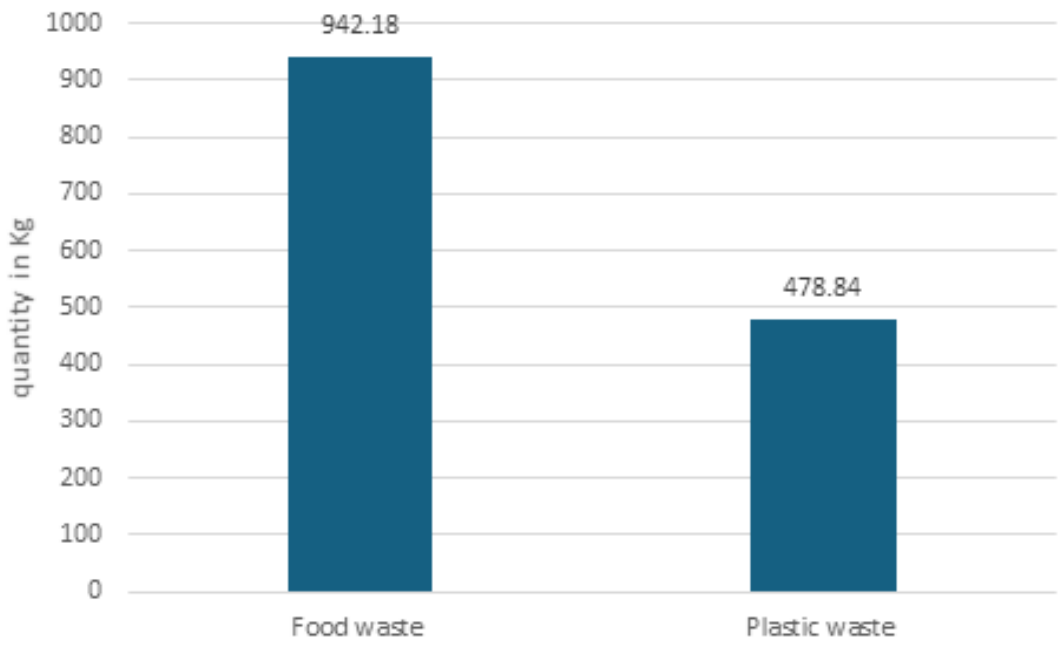


Fig 7.5 Total quantity of waste generated college canteen

Food waste in college canteens often outweighs the waste generated from plastic and paper, attributable to several interrelated factors. Firstly, the high volume of meals prepared daily, along with a diverse menu designed to accommodate various dietary preferences, frequently leads to overproduction and, consequently, surplus food. Additionally, students' eating habits, such as leaving meals unfinished or selecting larger portion options, significantly contribute to this issue. The canteen predominantly serves freshly prepared meals, with limited options for packaged food and beverages, which heightens the reliance on cooked items and further aggravates waste generation within the college.

Fig 7.4 Waste segregation point

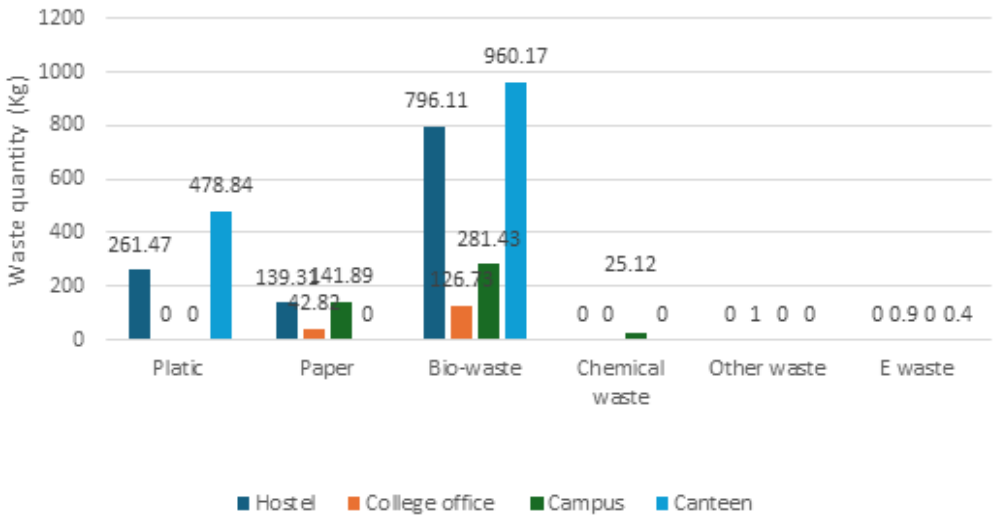


Fig 7.6 Waste composition by quantity in each zone

Food waste is notably higher on this campus compared to others, as recorded in campus data, primarily because the central canteen serves a large and diverse population — including students, staff, and guests. Since all meals are prepared and served on-site rather than as packaged items, and students dine in the canteen directly, the volume of food prepared and potentially wasted is significantly greater. The presence of plastic in the canteen is highly prevalent due to the purchase of cooking materials and packaged food, with waste generation closely tied to user demand. The college hostel, as the second largest user of plastic, contributes significantly to plastic waste through the consumption of packaged food, stationery, and personal items by college residents. In contrast, there is minimal plastic usage observed in the office and on campus, indicating a potential adherence to protocols aimed at reducing plastic consumption. Bio-waste is notably significant in the canteen, where freshly prepared meals are offered. However, fluctuations in user demand have resulted in increased waste generation. The canteen and hostel largely rely on mess food, while food waste from outside sources is attributable to students' and faculty consumption across the campus. Furthermore, paper waste is predominantly generated on campus, particularly within the office. The college's use of traditional examination methods and its role as a centre for academic evaluation contribute to heightened paper usage in both academic and administrative contexts.

Fig 7.5 waste management

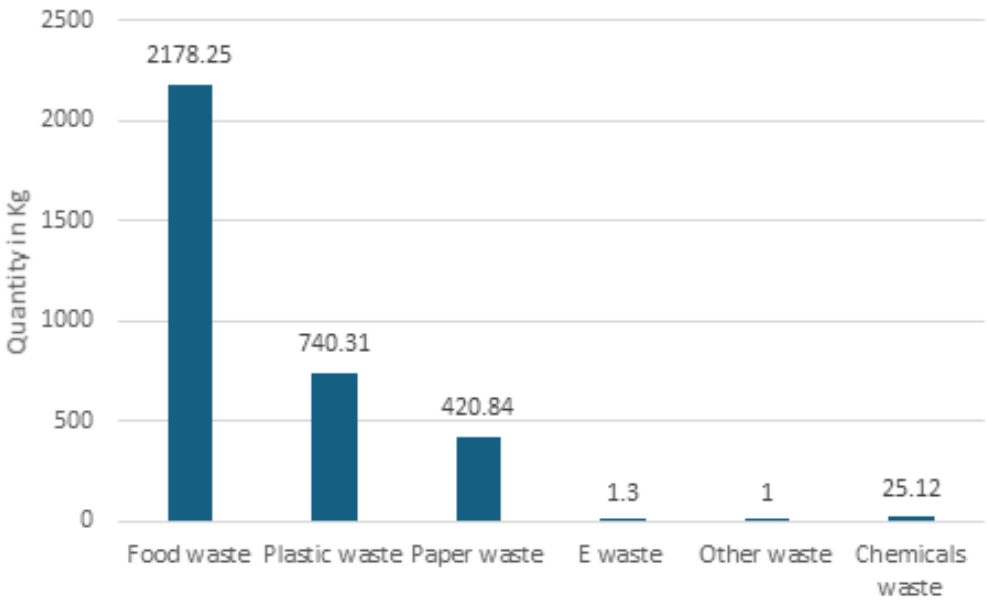


Fig 7.7 Waste generation trends in college

Type of waste generated	Hostel	College office	Campus	Canteen	Total
Plastic	261.47	0	0	478.84	740.31
Paper	139.31	42.82	141.89	0	324.02
Bio-waste	796.11	126.73	281.43	960.17	2164.44
Chemical waste	0	0	25.12	0	25.12
Other waste	0	1	0	0	1
E waste	0	0.9	0	0.4	1.3

Tabel 7.12 summary of site-wise and total wastes in each category

Based on the waste quantity assessment, it is clear that Organic waste is more dominant in college compared to paper and plastic, currently their only one biogas plant in the college, which is in the hostel of capacity 200 L, which is not currently functioning. Colleges manage food waste from campus is directly put into compost pipe the manure released from the pipe is use for manuring vegetation and plants. Identified inadequate segregation points for source segregation. A highlight of the study is that plastic waste is comparatively low in colleges that follow green protocol and restrict the use of single-use plastic, even in canteen packet food sells minimally, all plastic waste is collected monthly by Haritha Karama Sena, other waste, including electronic is handover to scrap dealer. There is no proper storage room or exact quantity measure documented in college. Based on the existing e-waste and responses from the college community, it has been taken to get the quantitative data on e-waste. Paper waste is reduced through digital communication and reuse paper for academic and administrative purposes, remaining paper is burned in incinerator of capacity of 100 and in hostel also which has capacity 50

College has to improve the waste management system special focus on managing food waste, and develop a behavior change approach to reduce the habit of food waste among the college community, like signage. Repaire existing biogas plant and install compost pit or Biogas plant in college thereby make use of the fuel and manure for vegetation already college has a vegetable garden inside the campus. Install segregation point in selected area with labeling ensure the source segregation it can monitor by waste management

committee either through CCTV or quick inspection or make a responsible housekeeping staffs to monitor. Place a store room to store e waste and other waste and record the quantity once in yearly

The waste quantity assessment indicates that organic waste is the predominant type of waste generated on campus, outpacing paper and plastic. Currently, the college operates one biogas plant located in the hostel, which has a capacity of 200 liters and is presently non-functional. Food waste from the campus is managed by directing it into a compost system, with the resulting manure utilized for fertilizing vegetation and plants. However, the assessment identified inadequate segregation points for source separation. Notably, plastic waste is relatively low in colleges that adhere to green protocols by limiting the use of single-use plastics; even the sale of packaged food in the canteen is minimal. All plastic waste is collected monthly by the Haritha Karama Sena, while other waste, including electronic waste, is handed over to scrap dealers. Furthermore, the college lacks a dedicated storage facility and precise measurement of waste quantities. With respect to electronic waste, efforts are ongoing to gather quantitative data reflecting community responses. Paper waste has been mitigated through digital communication and the reuse of paper for academic and administrative purposes, while any remaining paper is incinerated, with incinerators having capacities of 100 liters and 50 liters, respectively. To enhance the waste management system, the college should focus on improving food waste management and implement behaviour change initiatives, such as informative signage, to cultivate a culture of reducing food waste among the community. Repairing the existing biogas plant and installing either a compost pit or an additional biogas plant would enable the utilisation of fuel and manure for the college's existing vegetable garden. It is also recommended to establish clearly labeled segregation points in selected areas to ensure effective source separation, which can be monitored by the waste management committee via CCTV, inspections, or designated housekeeping staff. Additionally, a dedicated storage room should be established to store electronic and other waste, with annual records maintained to track quantities.

7.4.2 Current waste management practices

Type of waste	Factors Contributing to Waste Growth	Method of treating
Paper waste	Parcel covers, paper, covers, Printing wate, decorations, from the campus, canteen, hostel, and office	Burned, Efforts are taken to reduce use of printed documents in the college office and ballet over paper is burned
Plastic Waste	Packaged snacks, bottles, carry bags from campus, canteen and hostel	Monthly waste collection records maintained by the Haritha Karma Sena indicate that while entitlement cards are issued and available, the actual quantities of waste collected are not being properly documented or recorded

Bio-waste	Canteen and hostel produce bio waste due to cooking	College-generated biodegradable waste (from classrooms and offices) is composted in dedicated pits, and canteen waste is managed by designated canteen workers. While a functional biogas plant previously treated organic waste from the hostel and canteen, the institution has transitioned to a pipe composting-based system for bio-waste management.
Food waste	Discarded, unused, left to spoil food waste coming from the office, canteen, hostel, lunch boxes	Put in the compost pipe
Other waste (steel, mat, infrastructure and construction waste	Campus repairs, building work from surroundings of the Campus	Quantities of waste materials sold to small-scale external vendors are not being systematically recorded, hindering accurate identification and tracking of the volumes transacted
E-waste	Computer lab upgrades, broken electronics from Library, Office and Hostel	The disposal of segregated recyclables through sales to small-scale outside vendors lacks systematic documentation, preventing reliable identification and measurement of the quantities sold
Chemical waste	Experiments as part of academic activity From the chemistry Lab	Liquid and solid Chemical waste is collected in waste pit

Table 7.13 Waste management practices of the college

7.5 CONCLUSION

- The study reveals that organic waste constitutes the largest fraction of total waste generated, followed by plastics and paper. While organic waste is currently directed to compost pipes for conversion into manure used in campus agriculture, the capacity and effectiveness of these compost pipes appear inadequate to handle the volume of food waste produced. Additionally, the sole operational biogas plant (200-litre capacity) is not functioning properly. Laboratory bio-waste is being co-treated with food waste, which may compromise process efficiency and safety. Urgent attention is required to enhance food waste management systems. Strengthening composting and/or biogas processes would significantly contribute to the college's organic farming initiatives and promote sustainable nutrient cycling.

- The college demonstrates commitment to the Green Protocol through effective communication and awareness efforts, as evidenced by the moderate reduction observed in plastic waste generation. However, this approach requires further strengthening to achieve more substantial and sustained reductions. Moreover, the quantities of non-biodegradable waste handed over to the Haritha Karma Sena are recorded and documented; revenue generated from the sale of recyclable materials to external parties is also noted. In contrast, the quantities of e-waste, other miscellaneous waste, and chemical/hazardous waste rely solely on estimates provided by college representatives. These figures lack independent verification or systematic measurement, rendering them insufficient for accurate reporting, compliance monitoring, or performance evaluation.

7.6 RECOMMENDATION

Enhancement of Food Waste Management System: Organic/food waste in the campus audit findings, immediate upgrades to the existing infrastructure are essential. Repair and restore the non-functional 200-litre biogas plant to operational status, ensuring regular maintenance and monitoring. Increase biogas processing capacity through the installation of or larger units (e.g., scaled to match daily food waste generation estimates). Introduce and expand aerobic composting systems (such as windrow composting, vermicomposting, or in-vessel composters) to provide scalable, decentralised treatment options for surplus organic waste. These enhancements will improve nutrient recovery for campus agriculture, reduce methane emissions from improper disposal, and align with decentralised waste management goals promoted under the Haritha Keralam Mission.

Strengthening Recycling and Upcycling Initiatives: To maximise resource recovery and promote circular economy principles. Develop and implement a structured campus-wide recycling program, including improved source segregation, dedicated collection points, and accurate quantification of materials handed over to Haritha Karma Sena or other authorised recyclers. Launch student-led creative upcycling projects in collaboration with external agencies (e.g., local NGOs, Clean Kerala Company partners, or art/recycling organisations). Examples include transforming collected plastics and other non-biodegradables into demonstration statues, benches, garden art, or functional campus installations. Establish a formal plan with timelines, student group involvement, faculty supervision, and documentation of outcomes to raise awareness, foster environmental stewardship, and generate visible symbols of sustainability on campus.

Transition to a Paperless Communication and Academic Ecosystem: Prioritise the adoption of digital tools to significantly reduce paper consumption across academic and administrative activities. Mandate paperless processes for assignments, project reports, thesis submissions, internal assessments, and note-sharing through platforms such as Learning Management Systems (LMS), Google Workspace/Microsoft 365, or institutional portals. Encourage digitisation of lecture notes, handouts, syllabi, and examination-related materials, supplemented by training for faculty and students on effective digital tools. (e.g., 70–80% reduction in printing volume within 12–18 months) and monitor progress through periodic audits of paper usage. This initiative will not

only lower waste generation and costs but also reinforce the institution's commitment to the Green Protocol and broader environmental sustainability.

Installation of Informative and Motivational Signage for Waste Reduction and Proper Disposal: To foster positive behavioural change and reinforce responsible waste disposal practices, strategically install clear, visually appealing signage boards at high-traffic and waste-generation areas across the campus (e.g., canteens, hostels, classrooms, laboratories, administrative blocks, and near existing disposal points).

Establishment of Colour-Coded and Labelled Waste Segregation Points: Install dedicated and prominently placed waste segregation stations (bins or clusters) throughout the campus to encourage source segregation at the point of generation.

Adopt a consistent colour-coding system aligned with national and state guidelines (e.g., Swachh Bharat Mission and Kerala practices):

- Green bins: Biodegradable/organic/food waste (for composting or biogas).
- Blue bins: Dry/recyclable waste (plastic, paper, metal, cardboard).
- Black/Grey bins: Residual/non-recyclable/general waste.
- Additional separate collection points for hazardous waste (e.g., chemical/lab waste), e-waste, and sanitary waste as per institutional needs.

7.7 WASTE MANAGEMENT PLAN

7.7.1 Establishment of the Waste Management Committee and Allocation of Duties

The institution is establishing a formal Waste Management System (WMS) as part of its comprehensive Environmental Management System (EMS), demonstrating its commitment to promoting sustainability and environmental responsibility. This system will adhere to best practices for sustainable waste management and align with institutional and national green protocols. The dedicated Waste Management Committee comprises eleven student representatives and five faculty members, established to oversee and direct the implementation of the system. The committee will oversee the organisation, direction, and assessment of waste reduction plans; ensure that appropriate disposal and segregation procedures are followed; and raise awareness among all parties involved on campus. The college hopes to create a campus environment that is cleaner, greener, and more sustainable by using this methodical and interactive approach. In collaboration with the college administration, the WMS team will oversee the overall planning, coordination, and management of waste management operations. The team will help create awareness campaigns, oversee the management of departmental waste, and direct student involvement, working together to ensure that waste reduction, recycling, and sustainable waste disposal methods are implemented on campus in a coordinated manner.

7.7.2 Objectives:

By implementing sustainable waste management techniques, the Waste Management Committee at Mar Thoma College for Women, Perumbavoor, aims to cultivate an ecologically responsible campus. The committee's goals are to minimise the amount of waste produced overall, guarantee efficient separation at the source, and encourage recycling and composting wherever feasible. Through ongoing education and interactive projects, it aims to raise awareness of the value of waste reduction among staff, faculty, and students. In accordance with environmental regulations, the committee also aims to establish a systematic approach for the safe collection, storage, and disposal of various waste categories, including hazardous materials, e-waste, biodegradable waste, and non-biodegradable waste. Through frequent monitoring, audits, and the incorporation of green practices, the committee aims to transform the campus into a zero-waste, environmentally friendly space.

7.7.3 Formulation of Comprehensive Strategy

- The goal of the college's comprehensive strategy formulation for the Waste Management System is to create a structured, practical, and sustainable method of managing all waste types produced on

campus. Conducting a waste audit is conducted to determine the types, sources, and volume of waste. Develop Standard Operating Procedures (SOPs) for collection, source segregation, storage, and disposal or recycling

- Incorporates community involvement, awareness campaigns, and regular training to foster an environmentally conscious culture to ensure ongoing improvement in campus waste management procedures. The plan also incorporates monitoring systems and recurring reviews to evaluate progress and adjust actions accordingly.
- An efficient waste management system is built on education and knowledge. Even the best policies and procedures could be ineffective without an informed campus community. Instilling a sense of accountability and environmental awareness in all parties involved, students, faculty, support staff, and management, is the aim
- Employing waste reduction and environmental sustainability initiatives in college, in alignment with resource mobilization, sensitizing the college community to optimal usage and consumption

7.7.4 Communication Channel and Governance Structure for WMS

- The college has established a strong communication network and a well-defined governance structure to guarantee the efficient deployment and seamless operation of the Waste Management System. Under the direction of the head of the institution, a specialized WMS Committee oversees all system planning, operations, and monitoring. The WMS team oversees informing departmental faculty representatives and student coordinators of pertinent waste management policies, procedures, and updates.
- These representatives ensure that instructions are understood and followed locally by sharing the information with the broader college community, which consists of students, non-teaching staff, and other stakeholders. The primary channel of communication for regular updates is departmental WhatsApp groups, which facilitate quick and trustworthy information sharing. College notice boards also display general policies, awareness campaigns, and SOPs related to waste segregation, disposal methods, and eco-friendly practices.
- A distinct, specialised communication protocol is followed for important announcements or issues, such as modifications to vendor schedules, maintenance of composting units, or handling of hazardous waste, through official circulars and direct coordination with the relevant departments. All campus residents are kept informed, involved, and responsible for preserving a sustainable and clean environment thanks to this organised and open communication system.

7.7.5 Short-term and long-term goals

Both short-term and long-term objectives are outlined in the plan.

7.7.5.1 Short-term Goals

- Display posters and signage for proper disposal methods in classrooms, hostels, and common areas.
- Introduce monthly or quarterly campus clean-up drives involving NSS/NCC units and student volunteers.
- Set up a collection point for electronic waste (batteries, chargers, old gadgets) by 2027
- Collaborate with authorized recyclers for safe disposal of the E Waste

7.7.5.2 Long-term Goals

- The college's long-term goal is a digitally transformed, waste-free campus where sustainability is integrated into all aspects of the academic and administrative processes by 2028
- Significantly reduce paper consumption through digitization of administrative, academic, and exam processes.
- Establish a permanent waste recycling centre inside the campus.
- Work toward certifications/recognition such as

the Swachh Campus Award or the Green Campus Certification.

7.7.6 Continuously Monitoring and Enhancing the System

- Conduct annual waste audits of the campus to determine the source, category, and volume, based on assessment prepare reports
- Maintain and systematically manage logs and registers about the disposal, recycling, and hazardous waste documentation, ensuring that all waste management records are complete in the assigned timeline
- Coordinate and conduct monthly meetings for self-evaluation, reviewing progress made as well as challenges faced, and conducting follow-up.
- Solicit comments and proposals from the students, teaching and non-teaching staff through the WhatsApp group and feedback forms aimed at identifying changes and enhancing waste management practices.
- Assess to routinely evaluated through activity logs, volunteering, and contributions to clean-up drives and awareness campaigns. Peer and faculty coordinator feedback is gathered to assess the effectiveness and consistency of the system. These evaluations assist in identifying areas that require more encouragement or direction, as well as in identifying active contributors.
- Quarterly performance reports to guarantee accountability and transparency. These reports contain information regarding recycling rates, compost production, waste segregation effectiveness, awareness campaigns, and challenges. The management uses the reports to assess progress and make well-informed decisions about resource allocation and policy changes.
- The college performs yearly third-party audits to ensure credibility and evaluate ongoing improvement. These audits assess the success of green initiatives, waste management systems, and adherence to environmental standards. The audit reports' recommendations are used to improve systems, plan future strategies, and ensure the campus continues to adhere to sustainability objectives.

7.7.7 Conclusion and Follow-up

7.8 ACTIVITIES CONDUCTED

Campus cleaning

Programme	Environmental Day Programme
Organizer	NSS
Beneficiary	Students And Staff
Date And Time	05 June 2024,09:30 Am
Duration	Full Day
Objective	Promote Environmental Protection And Conservation
Outcome	Saplings Were Planted
No: Of Participants	80

The NSS Unit No. 57 of Mar Thoma College for Women, Perumbavoor, celebrated World Environment Day on 5th June 2024, highlighting this year's theme: "Our Land, Our Future."Principal Smt. Sherin T. Abraham inaugurated the event by planting a sapling, symbolizing the commitment to a greener future. The event was attended by NSS Programme Officers, volunteers, faculty members, and non-teaching staff, making it a collective effort towards environmental sustainability. As part of the initiative, saplings were distributed to students and faculty members, encouraging everyone to contribute to a healthier planet.

Awarenes class by haritha karma sena

Programme	Honouring Haritha Karma Sena
Organizer	NSS Unit No: 57
Associating Partner	Haritha Karma Sena
Beneficiary	Volunteers,Harithakarmasena Members
Date And Time	05 June 2024,03:30 Pm
Duration	1hr
Objective	To Recognise And Honour The Selfless Contributions Of Haritha Karmasena
Outcome	Motivating Them To Continue Their Environmental Efforts
No: Of Participants	60

Mar Thoma College for Women, Perumbavoor, honored Haritha Karmasena members on 5th June 2024 as part of its commitment to environmental sustainability. Principal Smt. Sherin T. Abraham inaugurated the occasion, marking the significance of their contributions. During the event, Haritha Karmasena members shared their experiences, inspiring students and faculty with their dedication to waste management and environmental conservation. Their interaction, along with the active participation of NSS volunteers, made the program a meaningful and impactful one.

Campus cleaning

Programme	Swachhata Hi Seva
Organiser	NSS
Associating Partner	
Beneficiary	
Date And Time	17th Sept 2024
Duration	17th Sept-2nd Oct 2024
Objective	For Making The Environment Clean And Increasing Awareness
Outcome	Cleaner Environments, Improved Public Health, And Increased Community Awareness About Sanitation And Hygiene.
No: Of Students	80

Under the banner of Swachhata Hi Seva 2024, the NSS Unit of Mar Thoma College organized a mega cleaning drive to promote cleanliness and environmental awareness. This initiative aimed to honor the principles of Mahatma Gandhi, who advocated for a clean and healthy environment. The event took place from 17th September to 2nd October, culminating on Gandhi Jayanti. The cleaning drive covered three key areas: the college campus, Asram LP School, and the local municipality. Additionally, a rally was organized to spread the message of cleanliness and sanitation.

MAR THOMA COLLEGE FOR WOMEN, PERUMBAVOOR

NSS UNIT NO: 57

SWACHHATA HI SEVA

OCTOBER 1

GANDHI JAYANTI CELEBRATION

MAR THOMA COLLEGE FOR WOMEN, PERUMBAVOOR

NSS UNIT NO: 57

SWACHHATA HI SEVA

OCTOBER 2

Cleaning Drive @ Perumbavoor Municipality

Awareness class

Programme	Awareness Class
Organiser	College
Associating Partner	NSS&IQAC
Beneficiary	Students
Date And Time	21st Jan 2025,9:30am
Duration	3hrs
Objective	To Educate And Sensitize Individuals On The Importance Of Proper Waste Management Practices, Promoting Environmentally Responsible Behaviors And Sustainable Lifestyles.
Outcome	Increased Awareness, Changed Attitudes, And Adoption Of Eco-Friendly Habits, Leading To Reduced Waste, Improved Recycling, And A Cleaner, Healthier Environment.
No: Of Students	700

On 21st January 2025, the NSS Unit of Mar Thoma College For Women, Perumbavoor, in association with Kudumbashree and Haritha Karmasena, organized an awareness class on Waste Management in Daily Life.

The session aimed to educate students, faculty, and staff about the importance of effective waste management and the simple practices that can be adopted to reduce, reuse, and recycle waste in their daily lives.

Swachhata hi seva

PROGRAMME	SWACHHATA HI SEVA
ORGANISER	NSS
DATE AND TIME	17TH SEPT 2024
DURATION	17TH SEPT-2ND OCT 2024
OBJECTIVE	For making the environment clean and increasing awareness
OUTCOME	Cleaner environments, improved public health, and increased community awareness about sanitation and hygiene.
NO: OF STUDENTS	80

Summary

Under the banner of Swachhata Hi Seva 2024, NSS Volunteers organised mega cleaning drive inside the college, Asram LP School and municipality which lasted for a period of almost 2 weeks from 17th Sept-Oct 2nd . Also, arranged a rally from college.Overall, we successfully celebrated Gandhi Jayanthi happily.


NATIONAL SERVICE SCHEME
MAHATMA GANDHI UNIVERSITY
UNIT NO : 57
COLLEGE NAME : MAR THOMA COLLEGE FOR WOMEN PERUMBAVOOR
Pledge/Rally from college to Onnammile/Dance and Flashmob
On 1st oct
Tuesday
3:30pm
SWACHHATA
HI SEVA 2024
17th September-2nd October 2024


MAR THOMA COLLEGE FOR WOMEN, PERUMBAVOOR
NSS UNIT NO: 57
SWACHHATA HI SEVA
OCTOBER 1
GANDHI JAYANTI CELEBRATION
MAR THOMA COLLEGE FOR WOMEN, PERUMBAVOOR
NSS UNIT NO: 57
SWACHHATA HI SEVA
OCTOBER 2
Cleaning Drive @ Perumbavoor Municipality

My Bharat

PROGRAMME	MY BHARATH
ORGANISER	NSS UNIT
ASSOCIATING PARTNER	GOVT OF KERALA,NYKS
BENEFICIARY	STUDENTS AND OUTSIDERS
DATE AND TIME	27TH OCT-30TH OCT
DURATION	-
OBJECTIVE	To maintain cleanliness, ensure smooth traffic flow, reduce congestion, and promote a safe and orderly environment.
OUTCOME	A cleaner, safer, and more organized community with reduced traffic congestion, improved air quality, and enhanced overall quality of life.
NO: OF STUDENTS	60

Under the banner of My Bharat, NSS Volunteers of our college helped in managing the traffic. Police Officers gave necessary instruction to the volunteers for the same. Also, our volunteers conducted a cleaning drive at Pakalveed.

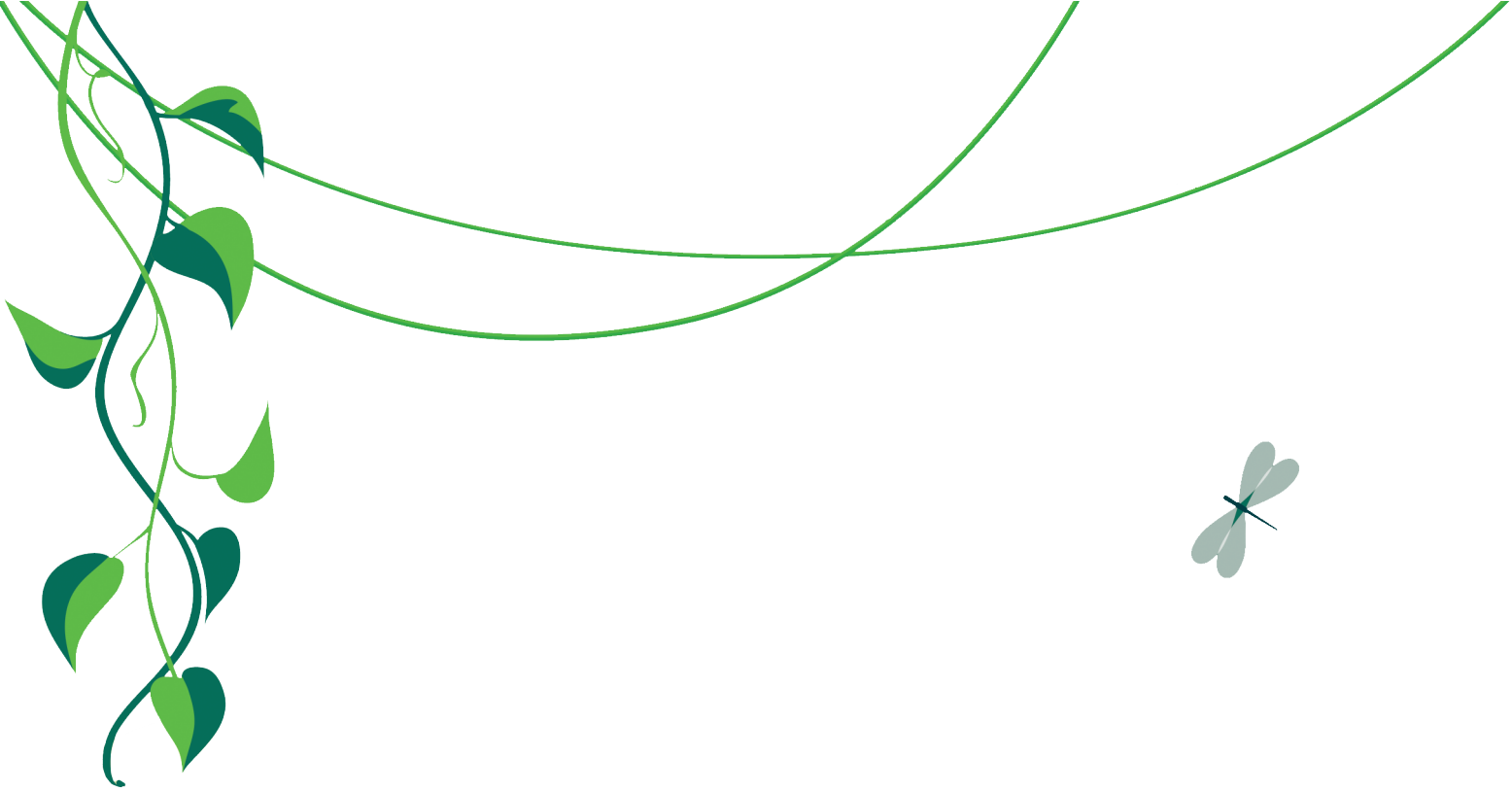
Overall,the program was a success.

"SMALL STEPS,BIG IMPACTS"

PROGRAMME	AWARENESS CLASS
ORGANISER	COLLEGE
ASSOCIATING PARTNER	NSS & IQAC
BENEFICIARY	STUDENTS
DATE AND TIME	21ST JAN 2025,9:30AM
DURATION	3HRS
OBJECTIVE	To educate and sensitize individuals on the importance of proper waste management practices, promoting environmentally responsible behaviors and sustainable lifestyles.
OUTCOME	Increased awareness, changed attitudes, and adoption of eco-friendly habits, leading to reduced waste, improved recycling, and a cleaner, healthier environment.
NO: OF STUDENTS	700

Summary

Our NSS unit in association with Kudumbashree and Haritha Karmasena, organised an Awareness class on Waste Management in our daily life on 21st January 2025, at our college campus. The session was inaugurated by Smt. Aney Martin, Vice Chairperson, Perumbavoor Muncipality and the classes were taken by our principle, Dr. Letha P. Cheriyan. The awareness session on waste management in daily life was a successful initiative in educating the participants about the importance of waste management and simple practices to reduce,reuse and recycle waste.



Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs

- Gro Harlem Brundtland -

Chapter VIII

OCCUPATIONAL HEALTH & SAFETY MANAGEMENT SYSTEM (OHS) : AUDIT REPORT

TIES

MAR THOMA COLLEGE FOR WOMEN PERUMBAVOOR
THE TRUTH SHALL MAKE YOU FREE

OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM COMMITTEE (2025-26)

Ms. Seira Susan Prasad
Co-ordinator
Dr. Sangeetha Rachel Koruth
Ms. Saritha N
Dr. Jismy Varghese
Ms. Manju Varghese
Mr. Gopikrishna S. Nair
Assistant professors

Fathima Nazarin M.Y.
Archana P.K.
Afnamol K.S.
Nimisha Maria Prince
Jisna Selin A. G.
Abhirami R. B.
Lakshmi Jayan
Fathima Aaliya K. A.
Afitha N.R
Afna Sherin K.A.
Akshara Binil
Aswani Rajan
Gopika V. Aji
Aishwarya Shiju
Fathima Shirin
Minnu George
Students

8

Occupational Health and Safety Management: Audit Report

8.1 INTRODUCTION

A comprehensive evaluation of Occupational Health and Safety (OHS) practices was conducted at Mar Thoma College in Ernakulam to assess the institution's compliance with established safety standards and identify potential hazards on campus. The audit, performed in accordance with ISO 45001 guidelines, focused on key areas such as infrastructure, emergency preparedness, chemical management, waste disposal, and the overall safety awareness among faculty, staff, and students. This report presents the main findings, observations, and recommendations aimed at enhancing the health and safety of all campus individuals.

ISO 45001 serves as the international benchmark for Occupational Health and Safety (OH&S) management systems, highlighting the importance of risk prevention, innovation, and continual improvement. It offers organisations a structured approach to enhance their resilience and operational performance. Attaining this global standard not only bolsters an organisation's capacity to manage OH&S effectively but also fosters increased engagement among students, faculty, and staff by clearly demonstrating a commitment to sustainable practices that promote a safe and healthy environment.

Additionally, health and safety audits enable institutions to evaluate the effectiveness of their safety protocols, offering valuable insights into their internal controls. These audits facilitate the early identification of risks, allowing for prompt corrective actions to mitigate potential hazards, which ultimately reduces the likelihood of accidents and unexpected incidents. This proactive strategy minimises potential disruptions, boosts stakeholder morale, and reinforces the institution's reputation, safeguarding it from adverse publicity that could affect its operations or partnerships.

Furthermore, ISO 45001 aligns an organisation's occupational health and safety management systems with its strategic goals, enhancing performance in this area while showcasing a robust commitment to employee welfare to customers, investors, and stakeholders. The standard's connection to the United Nations Sustainable Development Goals (SDGs)

underscores its significance. By adopting ISO 45001, organisations can demonstrate their leadership in sustainable development and their steadfast dedication to valuing and protecting their workforce.

8.1.1 What is a Health and Safety Audit?

A health and safety audit entails evaluating an organisation's systems, procedures, and policies concerning the health and safety of students and staff to verify compliance with established regulations. The audit aims to identify potential health or safety risks, assess the effectiveness of internal controls in managing those risks, and ensure compliance with regulatory requirements.

8.1.2 Need for Occupational Health and Safety Audit

Identifying deficiencies in an organization's safety procedures, evaluating compliance with regulatory requirements, and recommending improvements to safeguard the health and safety of its workforce. Additionally, ensuring that machinery, equipment, and facilities meet safety standards through thorough inspections.

8.2 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT POLICY

8.2.1 Statement of Commitment

Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" - definition for health given by WHO. As the Occupational Health & Safety Management Committee of Mar Thoma College for Women, we commit in fostering a workplace that prioritizes the health, safety, and well-being of all our students, staff, visitors, and stakeholders. We understand the necessity of safeguarding all the stakeholders of the institution and hence aim to provide the needed facilities, awareness and a safe and healthy atmosphere in the institution.

With reference to the SCG Safety Framework 2021, the basic element for OHS management includes risk management, management of change, emergency planning and response, mechanical integrity, stakeholders' safety management and safe work. The Occupational Health & Safety at Mar Thoma College for Women is looking forward to work and ensure to build responsible community by enhancing the performance and productivity of college community.

8.2.2 Goal

Cultivate a safe and healthy environment for all campus users by providing all the needed facilities to ensure health and safety, and to promote a proactive safety culture across the institution.

8.2.3 Objectives

- To develop and implement annual health and safety training programs.
- To conduct regular hazard assessments and risk control measures.
- To establish clear emergency response procedures and conduct drills.
- To provide accessible first-aid and basic healthcare resources on campus.
- To investigate all incidents/accidents and implement corrective actions.
- To ensure stability of mental health through interactive programs and mentoring.

8.2.4 Responsibilities

The health and safety of our students and staff are paramount to the successful operation of the college. To uphold this commitment, the institution will adhere to the following policies

College Management

- Ensure all campus areas, particularly academic buildings with upper floors, are fully accessible to persons with disabilities. This includes installing ramps and/or elevators and designating accessible parking spaces and restrooms in strategic locations.
- Establish a formal, collective process for proactively identifying and addressing the specific needs of students and staff with disabilities to foster an inclusive and supportive environment.
- Launch fundraising initiatives to support essential safety and wellness programs, including certified CPR training, fire safety drills, and professional counseling services for the college community.

- Although the campus is equipped with fire extinguishers, it is critical to implement mandatory training sessions. These sessions, conducted by qualified experts from the local fire department, will ensure that all staff and students can operate the equipment safely and effectively during an emergency.
- Install clear, standardized, and visible signage throughout the campus interior and exterior. This signage should communicate safety protocols, hazard warnings, emergency exit routes, and the location of available facilities. Priority areas include laboratories, workshops, and outdoor zones with high vehicle traffic.
- Ensure all laboratories are fully stocked with necessary Personal Protective Equipment (PPE), including gloves, safety masks, and lab coats.
- The designated lab supervisor or person-in-charge is responsible for enforcing strict safety protocols. This includes mandating the use of appropriate PPE for all individuals handling chemicals and ensuring that specific safety guidelines are prominently displayed within each laboratory.
- Conduct pre-monsoon inspections of all campus buildings to identify and rectify structural issues such as roof leaks and potential water accumulation in corridors, with a special focus on the upper floors to prevent slip-and-fall hazards.
- Implement a schedule for routine maintenance to address infrastructural vulnerabilities before they pose a risk to campus safety.
- Enforce rigorous maintenance of the canteen, ensuring high standards of cleanliness and food hygiene. Conduct regular audits to prevent the use of expired ingredients and to confirm that all food preparation and service adhere to FSSAI (Food Safety and Standards Authority of India) regulations.
- Mandate that all canteen staff wear appropriate attire (e.g., hairnets, aprons, gloves) and are trained in safe food handling practices.
- Establish a robust communication system using official channels (e.g., public announcement system, official email, designated WhatsApp groups) to issue timely alerts. These alerts should inform the campus community of ongoing construction, maintenance work, or any other activity that may pose a temporary disruption or safety concern.
- As a women's college dedicated to providing a secure environment, it is imperative to provide advance notification to students and staff regarding the presence of external workers on campus. This ensures transparency and reinforces the institution's commitment to student safety and well-being.
- The management must enforce a zero-tolerance policy against any form of malpractice, harassment, or misconduct by staff or external workers.
- All reported incidents must be investigated promptly and thoroughly. Appropriate disciplinary action, commensurate with the severity of the offense, will be taken to safeguard the student community and uphold the institution's integrity.

Employees (Staff and Faculty)

- All staff must immediately report any observed unhygienic conditions or unsafe practices among students or staff. Class teachers hold primary responsibility for their students' well-being on campus, ensuring that any health or safety concerns are promptly and effectively addressed.
- Actively mentor students to foster a stable and supportive environment for their mental well-being. Conduct regular, confidential check-ins (at a minimum of once per month) to provide a supportive outlet and identify students who may require additional support.
- Immediately report all medical emergencies on campus to the OHS (Occupational Health and Safety) Coordinator. Ensure prompt action is taken, especially when hospital care is necessary. Conduct thorough follow-ups on all incidents and maintain clear communication with parents to keep them informed and assured of their child's care.
- To maintain a mutually supportive and safe work environment, any health, safety, or other significant difficulties faced by staff must be communicated to the OHS Coordinator for assistance and resolution.
- Take the initiative to organize and coordinate essential training programs for both staff and students. Key areas include, but are not limited to, CPR, first aid, emergency response protocols, and personal development workshops to cultivate a

prepared and safety-conscious campus community.

- Ensure the meticulous maintenance of registers to track the expiry dates of all relevant materials, including first aid supplies, laboratory chemicals, and canteen food items. Regular monitoring of these records, particularly in science departments, is critical for proactive risk assessment and mitigation.
- Staff are required to actively monitor student behaviour to prevent academic malpractice and any actions that could be harmful to other students or staff. Following repeated warnings for misconduct, the issue must be formally escalated to the management for review and potential disciplinary action.
- Ensure housekeeping staff are properly trained and consistently monitored to maintain the highest standards of cleanliness and hygiene, particularly in restrooms. The campus sick room must be properly equipped, maintained, and regularly monitored to ensure it is a safe and sanitary space for students in need of care.

Students

- Students must promptly report any minor or major health and safety concerns to the Occupational Health and Safety (OHS) team. This can be done through the designated departmental WhatsApp groups, each of which includes an OHS representative to ensure a timely response.
- Students are expected to help maintain a respectful and supportive atmosphere within their classes and across the campus. Cultivating positive relationships is essential for creating a peaceful learning environment and ensuring no student feels isolated or distressed.
- For the effective functioning of our support systems, students should report any difficulties or hazards on campus using the assigned communication channels. Furthermore, students are encouraged to confidentially inform their respective class teachers of any significant illness, injury, or personal trauma that may affect their well-being.
- Students must familiarize themselves with and adhere to all institutional health and safety protocols, which are communicated in the prospectus during the admission process. This includes avoiding high-risk activities and selecting safe and secure locations for any institution-related tours or trips.
- Students are responsible for actively participating in programs, workshops, and drills designed to promote health and safety awareness. This active engagement is vital for fostering a secure and healthy community for everyone.

Visitors and other workers

- Visitors and workers are required to comply with the institution's health and safety policies. Engaging in activities that could cause harm to students, staff, or visitors is strictly prohibited. Any violation of these policies will result in disciplinary action.
- Any accidents, injuries, or potential risks must be reported immediately to the Occupational Health and Safety (OHS) help desk. Furthermore, any hazard observed on campus must also be reported promptly. Contact information for the help desk is displayed on campus notice boards.

Parents

- Parents are responsible for informing their child's respective class teacher of any physical or mental health conditions that may require monitoring or support during school hours. To ensure confidentiality and clarity, this information should be communicated directly, either in person or by phone. This partnership is vital for safeguarding your child's well-being within the institution.
- Parents are expected to familiarize themselves with and adhere to the institution's health and safety policies.
- Parents who identify a need for a facility or service to enhance student well-being, are requested to first discuss the matter with the class teacher. If further consideration is warranted, the teacher will help escalate the suggestion to the school administration.

8.2.5 Risk Management.

- Conduct scheduled, preventative maintenance on all campus water purifiers to ensure the provision of safe drinking water and prevent the outbreak of waterborne illnesses.
- The Occupational Health and Safety (OHS) committee is responsible for performing regular audits of the canteen and hostel mess. These inspections will verify FSSAI compliance, ensure premises cleanliness, and check for the proper handling and expiry of food items.
- The Housekeeping department is tasked with implementing a routine schedule for campus-wide fumigation and landscape maintenance. Priority must be given to clearing weeds and overgrown vegetation, especially along pathways and near parking areas, to mitigate risks from insects and reptiles.
- Prioritize critical infrastructure repairs, including leaking ceilings and damaged classroom furniture (desks and benches). These actions are non-negotiable for maintaining a safe and conducive learning environment.
- Install and maintain clear, visible signage across campus. This includes traffic-control signs at the main entrance, caution signs for potentially slippery surfaces (e.g., interlocked pathways during rainy seasons), and hazard warnings in designated areas to prevent accidents.
- Adhere to a strict maintenance and inspection schedule for all laboratory equipment as per OHS standards. This is crucial for mitigating the inherent risks for students and staff working in laboratories.
- All departments with laboratories must enforce the mandatory use of appropriate PPE. The institution is responsible for its provision. The lab-in-charge must report any equipment deficiencies to the OHS Coordinator, who will escalate the issue to the College Council if not resolved in a timely manner.
- In the event of an on-campus accident, the OHS Coordinator must be notified immediately. The designated hospitals for treatment are the General Hospital (Govt.), Perumbavoor, and Sanjos Hospital (private). Any staff vehicle used for emergency transport must be authorized by the OHS Coordinator to ensure proper protocol is followed.

8.2.6 Awareness and Education

Health and Safety

- The institution prioritizes the safety and empowerment of its students by conducting periodic self-defense workshops. In response to societal challenges, these programs are specifically designed to equip young women with the essential skills and confidence needed to protect themselves in critical situations.
- To foster a prepared and responsible community, the college facilitates programs for CPR and emergency first aid. Recognizing the critical need for immediate response in health crises, this training empowers students with life-saving skills to assist individuals experiencing medical emergencies, such as sudden cardiac arrest.
- The college is committed to supporting the mental well-being of its students through a variety of initiatives. Actively promote and provide access to seminars on mental health, stress-reduction workshops, and other supportive activities that encourage a balanced and resilient mindset.
- A key component of our educational mission is to empower students with a thorough knowledge of their fundamental human rights. These sessions are designed to not only inform but also to inspire students to become confident advocates for themselves and their communities, ensuring they have the motivation and understanding to claim their rightful place in all societal spheres.

Disaster Management

- Regular drills will be conducted to train students on safe and orderly evacuation procedures. In an emergency, an alert will be issued by the principal, through announcement or official whatsapp group after which the Occupational Health and Safety (OHS) team will initiate and manage response protocols based on the specific situation.
- The college's location is surrounded by water bodies rising water levels are a potential threat. To prepare for such an event, contact information for emergency rescue teams must be prominently displayed on notice boards and included in official college publications and digital channels.

8.2.7 Health and Well-being

- Strategically located and fully stocked first aid kits are maintained on every floor and in key areas throughout the college. A comprehensive First Aid Register is used to meticulously track inventory, log all new purchases, and monitor the expiry dates of all supplies. Supplies are dispensed by trained personnel only after a preliminary assessment of the need, in strict accordance with standard first aid protocols.
- The college is committed to student and staff well-being through the regular organization of health check-ups, vaccination drives, and medical camps. These initiatives are frequently conducted in collaboration with the college's National Service Scheme (NSS) unit to maximize engagement and community outreach.
- Counselling services are available on campus on Tuesdays and Thursdays. The service is provided by a counsellor appointed by the college's Jeevani Unit in the dedicated counselling room on the third floor. All session details are recorded privately and kept strictly confidential.
- The college promotes physical well-being through comprehensive facilities and programs. The Physical Education Department offers yoga classes, and students have access to a well-equipped, on-campus fitness centre. Furthermore, students are actively encouraged to participate in a wide range of sports and extracurricular activities to enhance their physical fitness, foster teamwork, and promote a balanced lifestyle.

8.2.8 Emergency Procedures

- An Emergency Response Team will be established under the supervision of the Principal and the Occupational Health and Safety (OHS) Team. This team will be composed of designated members from both faculty and non-teaching staff to effectively manage potential risks on campus.
- To ensure campus-wide preparedness, comprehensive training will be provided to all staff and students. This training, delivered by qualified internal personnel or certified external experts, will cover emergency handling, evacuation procedures, and regular drill protocols.

8.2.9 Accident and Incident Reporting

- Medical emergencies occurring on campus or in its immediate vicinity must be reported immediately to the OHS Coordinator. Responding staff are to accompany the affected individual to the hospital and must remain until a responsible handover to hospital staff or the individual's family/emergency contact is completed. A follow-up notification must be sent to the OHS Coordinator and the relevant department head. The incident must be formally documented in the Medical Incident Register, including the individual's name, nature of the emergency, hospital details, and the name of the accompanying staff member.

8.2.10 Community Engagement

- Implement student-led awareness programs on menstrual hygiene and other key women's health topics, such as menopause. These initiatives should engage the entire community, potentially through an "Adopt a Village" model featuring mass awareness campaigns and educational classes.
- Organize on-campus outreach programs to foster social responsibility. Key activities will include blood donation drives to support patients and accident victims, and hair donation camps to provide wigs for cancer survivors, directly benefiting the wider community.

8.2.11 Monitoring and Review

- A formal schedule of risk assessments shall be implemented and conducted by internal Health and Safety auditors on a recurring basis. The primary objective is to proactively identify, evaluate, and mitigate potential hazards to campus personnel, students, and visitors.
- To guarantee a safe and healthy campus environment, monthly compliance checks must be performed on all consumable goods, including pharmaceuticals and food items. All inspections

and their outcomes must be formally logged in an official register, subject to regular review.

- Monitor the registers and documents, updated to comply with internal standards and external regulations. This includes the diligent maintenance of registers for laboratory calibrations, chemical management, emergency procedures, and confidential medical records.

8.2.12 Communication

All matters regarding the occupational health and safety will be communicated by the OHS Coordinator to the heads of the departments and to the college union members through which it will reach the entire college community. General instructions about health and safety, details of emergency numbers must all be displayed through notice boards in the front of the institution.

8.2.13 Compliance & Review

The institution has duly established an OHS Committee in accordance with applicable national labor and safety regulations. The members must fully be committed to complying with all provisions outlined in its Occupational Health and Safety (OHS) Committee Policy. The institution must ensure that necessary resources are provided to support the Committee's operations and continuous improvement of the workplace safety environment.

8.3 METHODOLOGY

The OHS Management Committee acts as the internal audit team and is made up of seventy members, including six faculty members and sixty student representatives. A thorough register and documentation system has been implemented to enable regular assessment and monitoring of safety practices for staff, students, and visitors to the campus. This system comprises two registers and four key documents. It functions by the institution's OHS policy, which outlines specific goals, action plans, and strategies for safety management. The committee convenes regularly to review progress and verify the effectiveness of these safety initiatives.

8.3.1 Internal Audit Training

Green audit training fosters institutional commitment and involvement through extensive, collaborative methods. In preparation for this, the college's Environmental Management System (EMS) identifies students and faculty members to participate in a one-day internal audit program. This program certifies them as internal auditors capable of performing an Occupational Health and Safety audit, which includes evaluating, analysing risks, collecting data, developing policies, and documenting water conservation initiatives and records.

8.3.2 List of register and document to monitor OHS

A review was conducted to evaluate the organisation's Occupational Health and Safety (OHS) framework, covering policies, procedures, and records of compliance. This evaluation involved examining: (1) safety protocols, (2) methods of communication, (3) plans for emergency response, and (4) reports of incidents. Various potential hazards were pinpointed across different campus locations, specifically: practices for storing chemicals in laboratories, physical dangers in workshops/laboratories and general activity spaces; issues related to food safety, sanitation, and hygiene; management of vehicle traffic and pedestrian movement on and around the campus; and ergonomic issues in campus settings.

8.3.3 Respondent's comments and observation

The Internal Audit team performed thorough examinations of campus facilities to evaluate safety practices, maintenance status, and adherence to safety regulations. At the same time, the team interacted with staff, faculty, and students to collect their insights on health and safety experiences and perceptions. The audit also involved an in-depth analysis of current risk control measures, assessing their effectiveness in addressing identified hazards, as well as an evaluation of the documentation concerning health and safety training procedures for both staff and students.

8.3.4 Campus Noise & Tree Mitigation Study

The assessment measures fluctuations in noise levels across the college campus employing a systematic sampling approach. Sound levels were recorded at ten chosen sites, which included noisy zones near roadways and spaces next to prominent trees, utilising a

portable digital sound level meter. The data is captured in Decibels (dB). Noise levels will be recorded in sets of three (covering minimum and maximum readings) during the morning, midday, and evening. The main goal is to pinpoint areas with high noise levels on campus and analyse the findings to determine the effectiveness of urban trees in reducing noise.

8.3.5 External Audit

An external auditor assesses compliance with Occupational Health and Safety management standards. If only minor discrepancies are identified, the organisation may receive approval for ISO certification.

8.3.6 Assumption

Developing robust occupational health and safety (OHS) protocols is essential for the sustained success and reputation of educational institutions. The physical and mental well-being of both staff and students directly affects the institution's current and future performance. By implementing a structured OHS management system, particularly one compliant with the ISO 45001 standard, institutions can create safe, engaging, and efficient environments. These systems are designed to mitigate risks to prevent injuries and health-related issues among all personnel and students.

The commitment to OHS yields numerous advantages, including a visibly safe learning environment, compliance with local and national regulations as well as sector-specific standards, reduced institutional liability and legal exposure, enhanced operational efficiency, and an improved public perception as a responsible and sustainable organisation.

Systematic OHS audits help to identify key areas for improvement such as safety in laboratories and classrooms, ergonomic hazards, the management of chemical and biological risks, fire safety, emergency preparedness, and slip/fall prevention. This promotes a pervasive safety culture that positively impacts employee morale, job satisfaction, and attendance. Tangible outcomes often manifest in reduced compensation claims from staff and students, increased community trust, better talent retention, and enhanced productivity.

Achieving these results necessitates the active participation of all stakeholders: Administration leads the formulation and enforcement of policies; faculty and staff are responsible for adhering to safety procedures and reporting hazards; and students are expected to follow safety protocols. Continuous improvement is supported by regular evaluations of OHS performance, routine risk assessments, identifying potential hazards, implementing controls (including equipment and training), providing initial OHS orientations, offering ongoing education with specialised training as needed, and maintaining comprehensive and practised emergency response plans. Ultimately, emphasising OHS is vital for safeguarding individuals, fulfilling regulatory requirements, and fostering a successful and reputable educational institution.

8.3.7 Stages of Occupational Health and Safety Management Audit

Occupational health and safety management audit has three phases: Pre-audit, audit, and post-audit.

8.3.7.1. Pre-audit phase

- Formation of audit team; scheduling audit programmes
- Setting up of scope and objectives (in tune with the occupational health and safety management policy of the institution)
- Discusses with the responsible persons of each location (staff, teachers, lab assistants, sweepers, watchmen, students, etc.) about the waste generation pattern, and provisions of their management.
- Documentation of all existing materials and provisions for health and safety measures inside the campus.

8.3.7.2. Audit phase

Auditors collect all data to ensure that nothing is overlooked completely in the audit. The following information has been collected during the audit phase:

- Assessment of collected data in relation with environmental policy and waste management policy of the college/university

- Review of present emergency health and safety management systems and enhancement suggestions

8.3.7.3. Post audit phase

- The plan of action for the post-audit phase implementation and follow-up. All possible suggestions for the improvement of OHS in the respective institution.
- OHS committee will ensure that the Occupational health and safety Management System is functional at expected level and the college is participating, by making the entire college/university community well informed through regular communications, monitoring through periodical evaluation programmes etc.

8.3.8 Steps of Occupational Health & Management Audit

8.3.8.1. Site assessment

Collection of contour map and campus diagram; For ensuring safety infrastructure and alternative method applied during renovation of campus.

Walk through survey; Identification of risks and their nature, category etc.: recording existing practices and provisions regarding OH&S system in the college.

8.3.8.2. Data analysis

- Analysis of current and past performance (pre audit and post audit performances, previous audit data etc.)

8.3.8.3. Final audit by external audit team

- Data verification- identifying non conformities
- Action plan –long tern and short term
- Final report & certification as per ISO standards.

8.3.8.3 Work plan and schedule of occupational health and safety report

Date to Date	Work Plan
17/03/2025 - 21/03/2025	The internal audit team has been divided into three units, each of which will work alongside the housekeeping staff in their respective areas to collect detailed insights into current waste management procedures, with a focus on the handling of hazardous materials, while upholding all relevant health and safety requirements for housekeeping employees.
24/03/2025 - 28/03/2025	Undertake a detailed risk analysis to examine critical threat variables, uphold regulatory standards, and provide a foundation for well-informed strategic planning
03/07/2025 - 14/07/2025	Carry out a thorough evaluation of the college's infrastructure, paying special attention to the health and safety provisions in the canteen and the condition of the electrical wiring throughout the building

17/07/2025 - 21/07/2025	Each group is tasked with carefully reviewing and recording the current emergency safety management procedures in their designated areas. Following this, every group must create a formal policy and a practical safety plan, then hold internal audit meetings to share their findings, discuss important matters, and summarize the results of their deliberations.
24/07/2025 - 28/07/2025	Every group should review the college's current safety guidelines, be aware of their management duties in their assigned areas, and recognize any possible risks or dangerous situations
07/10/2025 - 09/10/2025	Sampling of voice recording

Table 8.1. Schedule of occupational health and safety audit

Activities	Frequency	Dates of study	Mode of data collection
Sound recording data	9 days; three times a day	14/10/2025 (working day) 15/10/2025 (working day) 16/10/2025 (working day)	Entry in the given format

Table 8.2. Workplan of occupational health and safety audit

8.4 RESULT AND DISCUSSION

Ensuring safety on campus is a fundamental legal responsibility for educational institutions, as mandated by Occupational Health and Safety (OHS) regulations. Failure to comply can lead to serious consequences, including legal action and reputational damage. In contrast, adherence to OHS standards not only offers legal safeguards but also cultivates crucial trust within the community. This commitment is vital for safeguarding students, especially minors, by guaranteeing well-maintained facilities and a secure environment for all staff, which in turn boosts morale and productivity. Ultimately, fostering a strong safety culture is both a legal and ethical requirement; it also provides reassurance to parents, strengthens community ties, and enhances the institution's reputation and enrolment potential.

8.4.1.OHS System of the College

To foster a safe and effective environment for its community, the college implements an Occupational Health and Safety (OHS) management system that adheres to ISO 45001 standards. This holistic framework enables systematic monitoring of health hazards and ensures the safety and reliability of essential resources, including laboratory equipment, canteen offerings, and first-aid supplies, while effectively managing visitor access to enhance overall security. Clearly defined emergency protocols have been established to promote safety and strengthen the institution's credibility. In alignment with international standards (EU-OSHA, HSE, OSHA), the college incorporates OHS principles into the educational framework through a comprehensive "whole-institute" model. This strategy integrates risk awareness, health promotion, and respect initiatives into both the curriculum and campus culture, cultivating a thorough understanding of safety that goes beyond isolated discussions. Collaboration with relevant authorities further reinforces this interconnected approach.

College Community Engagement and Entertainment Program

8.4.2. Risk areas of the college and existing OHS facilities:

SL.NO.	RISK AREA	TYPE OF RISK	HAZARDS	EXISTING OHS SYSTEM
1	Chemistry, Zoology, Botany, and Biochemistry laboratories	Chemical, physical, biological	Toxins Burning chemicals Pathogenic organisms	Mandatory use of appropriate protective gloves and laboratory coats when handling toxic or hazardous chemicals. Availability of fully equipped first aid kits, prepared in consultation with a qualified nurse or medical professional. Provision of adequate ventilation, proper lighting, comfortable working space, and appropriate physical layout to ensure a safe and ergonomic environment.
2	Physics, computer and language laboratories	Contact with electrical equipment	Possibility to get electrical shock	Always wear appropriate safety footwear in laboratory areas. Install ELCBs (Earth Leakage Circuit Breakers) to protect against electric shock caused by leakage currents. Maintain a reliable and effective earthing/ grounding system for all electrical equipment. Use only insulated wires, cables, and sockets that meet relevant safety standards. Conduct regular electrical maintenance, periodic inspections, and testing of all installations and equipment.

3	Roads and campus safety	Vehicle accidents The current road safety measures along the primary route to the college are inadequate. The section of the road between the buildings and the canal is significantly congested. Although a footpath exists alongside the canal, it is not provided with safety barriers, thereby increasing the risk of accidental falls into the water The internal roads lack dedicated pedestrian walkways and appropriate signage.	Health issues including fatality Road accident Falling into canal	Installation of prominent warning signs in high-risk areas. Implementation of CCTV surveillance to enable rapid emergency response. Introduction of an efficient parking management system to reduce congestion. Construct a barrier along the side of the canal to prevent failure

4	Canteen, Hostel mess and other food serving areas	Key areas of concern include sanitation, personal and environmental hygiene, food safety practices, drinking water quality, and the safe installation and use of LPG connections	Food poisoning; health issues Possibilities for rapid fire and leaking	Maintains high standards of cleanliness and sanitation in all food preparation, cooking, and serving areas. Ensures strict adherence to personal hygiene practices among cooks, kitchen staff, and service personnel. Conducts regular testing and monitoring of water quality used in food preparation and beverage service. Implements systematic and timely waste collection, segregation, and disposal procedures. Uses only ISI-marked LPG cylinders, regulators, and associated piping/hoses. Provides adequate ventilation and exhaust systems in all kitchen and cooking areas. Ensures availability of functional fire extinguishers and other fire safety equipment in easily accessible locations.
5	General issues Water quality-related issues	Water-borne or water-related diseases	Infections and the spreading of water-borne diseases	Periodic testing of water quality, along with cleaning of the water tank and associated fixtures twice a year
	Electrical distribution system of the college	Improper earthing Unbalanced and a lack of harmonious	Shocks to users damages to equipment	ELCB (Earth Leakage Circuit Breaker) to prevent shock due to leakage current. Proper earthing system for all equipment. Use of insulated wires and sockets. Regular electrical maintenance and inspection.
	Ragging Sexual harassment Workplace Violence	Mental well-being of the college community	Conflict between the college students and minor family issues of students	Anti-Ragging Committee with faculty and student representatives. Display of helpline numbers and awareness posters in hostels, classrooms, and common areas. Anti-ragging undertakings from students. Conduct orientation and awareness programs for new students. Conduct of mental health awareness programs.
	Frequent health issues	Physical well-being	Infections Diseases Accidents Mental stress	Availability of clean drinking water and healthy food options.

6	Women safety	Psychological well-being	Safety Health Social support	Counselling facility is available on every Tuesdays and Thursdays. Counselling and psychological well-being related programs are being conducted. Health and safety awareness programs. Social support systems such as grievance redressal cells and women helplines.
7	Emergency response system	Safety protocol	Diseases Disaster Medical emergency	Emergencies managed by staff in coordination with local hospitals. Signed MoU with Aster mendicity for emergency medical service
8	First Aid Frailties	Emergency medical support	Injuries Diseases Accident	Provision of emergency medical support. Availability of first aid kits with the assistance of Medical qualified expert
9	Infrastructure facilities	Outdoor and indoor facilities Hostel	Safety Emergency exit Recreation Networking	Safe outdoor and indoor facilities. Availability of staircases in all corners and also in the centre.
10	Register and documents	Safety Health Emergency	Safety and security framework procedures for incident management, the implementation and practice of emergency protocols through regular drills, and the enforcement of campus access control measures.	Maintenance of records for medical emergencies and rescue.

Table 8.3 Risk assessment summary, prevailing practice and facilities

Fig 8.1 College lab facilities

8.4.2.1. Health

- The college maintains a well-equipped first-aid facility to address immediate medical needs on campus. Initially managed by departmental teachers for basic aid requests from students, the system has been strengthened following an internal audit. A dedicated, medically qualified staff member (with appropriate certification) has been assigned as the primary first-aid responder and is stationed at the reception area for prompt accessibility. Contact details of the first-aid personnel, along with emergency protocols, nearby hospitals, and ambulance services, are prominently displayed on the main notice board, strategic signages across the campus, and in the college diary/handbook. This ensures widespread awareness and quick access to medical support for all students, staff, and visitors.

- The college operates well-maintained laboratories for Botany, Zoology, Chemistry, and Physics, which support undergraduate academic practical sessions. As the institution does not conduct research activities or host Ph.D. scholars, these facilities are primarily dedicated to curriculum-based experiments with controlled usage. All students are required to strictly adhere to laboratory safety protocols, including the mandatory use of white lab coats during sessions involving chemicals or hazardous materials to ensure personal protection and prevent cross-contamination. Comprehensive safety instructions are provided to students prior to each practical session. A detailed usage register is maintained in each laboratory to track and record the quantities of chemicals and materials consumed. Lab attendants and concerned faculty members supervise all sessions to enforce compliance and provide guidance. Safety signage, prepared by the Head of the Department (HoD) and the respective lab in charge, is prominently displayed in all laboratories to reinforce hazard awareness.

- The campus canteen and hostel mess function in full compliance with food safety regulations. They hold valid and up-to-date health certificates for staff, medical fitness/health cards, FSSAI certification (as applicable based on turnover and operations), and other required licenses. This ensures adherence to stringent hygiene and food safety standards. Expiry dates of all packed food items are systematically monitored, and raw materials are procured solely from certified and approved vendors. A recent occupational health and safety (OHS) risk assessment confirmed that staff wear hair caps and appropriate cooking attire during food preparation and service. To further promote hygiene, the use of gloves for food handling is under active consideration for implementation. In alignment with sustainability and health promotion goals, the canteen does not sell packaged food items (to discourage plastic usage and consumption of processed/unhealthy foods), focusing instead on freshly cooked, nutritious meals served on campus.

Fig 8.2 Open physical fitness centre

- An annual water quality analysis is conducted by a recognised laboratory to assess physical, chemical, and bacteriological parameters of the drinking water supply. The most recent report confirms that the water meets safety standards and is potable. Water from the main supply is distributed to overhead storage tanks across the campus. Additionally, water tanks undergo thorough cleaning, and surrounding areas are chlorinated biannually under the direct supervision and coordination of the college caretaker, who assigns and oversees the designated staff to carry out these maintenance activities effectively. Regular monitoring ensures consistent access to safe drinking water for the entire college community.

8.4.2.2 Emergency Management System

- Occupational Health and Safety (OHS) Auditors are responsible for maintaining comprehensive records and registers related to medical incidents, with particular emphasis on health hazards such as workplace accidents and chronic health conditions occurring on campus. This includes detailed documentation of laboratory equipment and chemicals, encompassing purchase dates, expiry dates, and calibration records. Additionally, they maintain registers for emergency rescue measures, an inventory of first-aid supplies (including expiry dates), and a list of food items in the canteen and cafeteria (with their respective expiry dates). All reported incidents and subsequent actions, both internal and external, are systematically recorded to ensure accountability and transparency. These records undergo periodic review to continually improve the effectiveness of the institution's safety and health management system.

Fig 8.3 College Community Awareness & Training Program

- The campus auditorium is equipped with four portable fire extinguishers (two with 4 kg capacity and two with 2 kg capacity). The extinguishers located in the college and laboratory areas, as well as within the auditorium (which is situated in an isolated building on the same premises), are currently maintained manually by the college caretaker. Periodic inspections are conducted to verify operational readiness. Emergency staircases are provided at each corner to facilitate safe evacuation.

- To strengthen emergency medical support, the college has entered into a Memorandum of Understanding (MoU) with Aster Medcity, Kochi. Under this agreement, healthcare services are extended to staff, students, Trust Members, and their dependents and in-laws from Mar Thoma College for Women. Beneficiaries are required to present their college ID card to avail these services. Payments are made directly by the beneficiaries at the time of service. The MoU provides the following additional benefits:

✓ Nil registration charges for new patients
✓ 20% discount on outpatient (OP) consultations
✓ 20% discount on health check-up packages
✓ 10% discount on laboratory and radiology services (when paid directly by the individual or institution)
✓ 10% discount on inpatient bills (excluding the cost of implants)

- The Women's Cell of the college is dedicated to promoting the holistic development of female students by prioritizing their mental and physical well-being, financial independence, awareness of rights, and legal protection. To achieve these objectives, the Cell collaborates with subject-matter experts to organize sessions on health, hygiene, lifestyle management, legal rights, and fitness training, along with workshops on healthy eating habits. It also facilitates exhibitions for women entrepreneurs and conducts interactive sessions with industry professionals to introduce emerging technologies and effective marketing strategies. Furthermore, through partnerships with legal experts, the Cell empowers women by raising awareness of their rights, facilitating access to justice, and providing essential resources and support to address instances of violence or harassment.

Fig 8.4 Cycling Amenities at the Campus

- In association with the audit, special emphasis is placed on electrical safety across the campus. This includes meticulous maintenance practices to prevent exposed wiring, regular cleaning of the campus premises, and timely execution of necessary repairs. The institution ensures effective supervision and direction of assigned staff, preferably qualified electricians, to carry out these responsibilities efficiently and safely.

- The institution employs three housekeeping staff members to maintain cleanliness throughout the campus. Cleaning is typically performed twice daily (morning and evening), with additional sessions scheduled based on institutional requirements and demand. Given that the student and staff strength is below 1,000, the current frequency of cleaning is considered adequate. Housekeeping personnel are provided with uniforms to promote safety, hygiene, and professional identification while ensuring comfort and ease of movement during physically demanding tasks. These uniforms serve as a protective barrier against cleaning chemicals and dirt.

Fig 8.5 Entrance Security Check with Login Book to Restrict External People

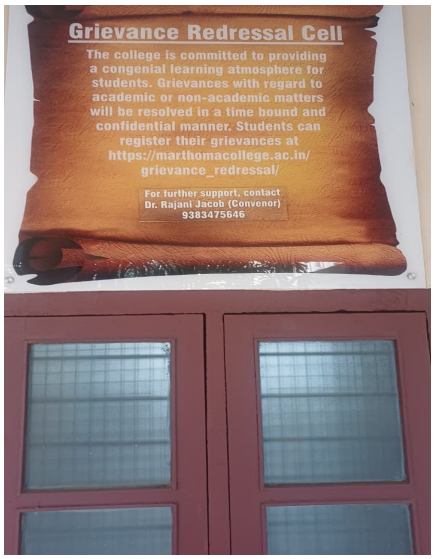


Fig 8.6 Grievance Redressal & Anti-Ragging Policies

8.4.2.3 Existing Facilities and Safety Gears

- The hostel mess and canteen maintain basic hygiene standards. Measures should be strengthened to ensure that kitchen staff consistently wear appropriate attire, including caps, gloves, and aprons where required, and that serving areas are cleaned regularly and systematically. While the kitchen team follows strict hygienic practices, efforts are needed to standardise canteen operations and elevate service quality to a more organised and professional level, moving beyond the conventional informal canteen model. Seating arrangements are provided separately for staff and students to reduce congestion and promote orderly usage. The canteen uses durable steel and ceramic utensils, and cleaning staff diligently segregate waste to facilitate effective disposal and recycling.

- Filtered drinking water systems are installed at designated locations across the campus. These systems are regularly tested for quality, and water is stored in clean, covered containers to prevent contamination. Waste disposal is managed in a systematic manner campus-wide to maintain sanitary conditions and minimize health risks. The institution provides comprehensive sports facilities for both indoor and outdoor activities, enabling students and staff to engage in physical recreation beyond regular academic hours. A well-equipped gymnasium is also available on campus. Ensuring the safety and proper guidance, the appointment of a certified physical

education trainer or fitness instructor is strongly recommended to assist and supervise participants effectively.

With a steadfast focus on health and wellness, the institution has actively promoted cycling as a sustainable mode of transportation within the campus. This initiative reflects a commitment to fostering a positive impact on both student well-being and the broader environment. By encouraging the use of bicycles as a primary means of on-campus mobility, the institution contributes meaningfully to the principles of sustainable development. As a result, commuters residing on or near the campus have increasingly embraced this non-motorised mode of transport as a preferred choice. A substantial number of bicycles are made available on campus to inspire greater student participation and lead by example.

The institution firmly believes that this commendable endeavour can advance sustainable and inclusive mobility while delivering enduring benefits including zero emissions, improved physical health, and a reduced environmental footprint

Fig 8.7 CCTV Surveillance System for College Event Monitoring

8.4.2.4 Training and Awareness Programme

- The college places a strong emphasis on cultivating a safe, respectful, and supportive campus environment. To this end, regular awareness programs and sensitization workshops are conducted to promote respectful interactions and prevent harassment. A robust grievance redressal mechanism is in place, facilitating confidential reporting and timely intervention. Faculty members and assigned mentors engage regularly with students to proactively address concerns and prevent escalation. In addition, through a Memorandum of Understanding (MoU) with Aster Medcity, the college benefits from specialised medical-related training and support services. These include employee engagement activities, dedicated health support initiatives, health awareness talks, both onsite and online sessions, Basic Life Support (BLS) training, formation of Rapid Response Teams (RRT), and medical assistance for outdoor events.
- To support psychosocial well-being, the college operates a dedicated Counselling Centre named JEEVANI (in alignment with the Government of Kerala's statewide initiative for college student mental health). The centre is staffed by full-time qualified counsellors with expertise in psychology, including Ms Anu Bijoy. All first-year students receive a comprehensive orientation on the availability of counselling services, along with clear procedures for accessing support. Sessions are conducted confidentially, and serious issues such as domestic violence or physical abuse are referred to specialised expert teams for appropriate intervention.

Fig 8.8 Outdoor Sports Court Complex

8.4.2.5 Infrastructure Assessment

- The institution maintains a comprehensive Occupational Health and Safety (OHS) system for road and campus safety. Dedicated security personnel actively monitor vehicle movement within the campus to prevent accidents and ensure compliance with traffic protocols. The latest OHS risk assessment report identifies challenges such as inadequate parking facilities and the limited presence of standard signage. To mitigate traffic flow conflicts beyond campus boundaries, entry and exit points are strictly controlled. Security staff are assigned to regulate outsider access, with a visitor registration system in place to record details of all external visitors. An information desk and centralized notice board are provided at the main entrance to facilitate communication, address inquiries, and disseminate important updates. Additionally, an amenities room is available behind the auditorium for immediate restroom access, while accessible signage is prominently displayed in laboratories and at the college entrance.

- A network of surveillance cameras is strategically deployed across key campus areas to enable continuous monitoring of activities. This system provides effective oversight even during periods without on-site security personnel, promotes adherence to institutional norms, and supports prompt incident response and emergency management.

- Adequate and well-maintained washroom facilities are available, with clear directional and accessibility signage to guide all users. Separate facilities are provided for men and women to ensure privacy and convenience. In women's washrooms, sanitary napkin vending machines (with a capacity of 10 pads, priced at 5 each) and designated disposal units are installed to support hygiene needs. Housekeeping staff manually refill the vending machines and perform regular maintenance to uphold cleanliness standards and control odours. While these facilities are effectively communicated through non-teaching staff and housekeeping personnel, and supported by strategic signage throughout the premises, there is currently no formal system to track purchases, procurement, or stock replenishment. Implementing a structured recording mechanism would enhance inventory management and operational efficiency.

Fig 8.9 Pad vending machine

8.4.2.6 Empowering Inclusive Systems and Community Engagement Initiative in College

- The institution has established three key initiatives under the umbrella of social welfare: Snehasparsham, Snehasanthwanam, and Snehasarvada. These programs primarily focus on supporting economically disadvantaged students and the broader community through targeted interventions:

✓ Snehasparsham: A noon-meal scheme designed to provide nutritious meals to financially underprivileged students, ensuring they can focus on their studies without the burden of hunger.

✓ Snehasanthwanam: Financial assistance extended to students and staff during medical emergencies, offering timely support to alleviate the economic impact of unforeseen health crises.

✓ Snehasarvada: A skill-development program that delivers free training to economically disadvantaged and socially marginalized students, empowering them with employable skills and greater opportunities for self-reliance.

- The institution demonstrates a strong commitment to inclusivity and accessibility for persons with disabilities. Facilities include ramps and rails at the entrance to the auditorium and leading to classrooms, enabling easier access. Wheelchairs are readily available at the reception/information desk. Additionally, scribe services and other examination accommodations are provided upon formal request, supported by appropriate medical or certification documents.

- Under the coordination of the NSS and NCC units, the college regularly organizes impactful community outreach activities, including blood donation camps, hair donation drives, and health check-up camps. These initiatives benefit both the college community and the wider public, fostering a culture of service and social responsibility.

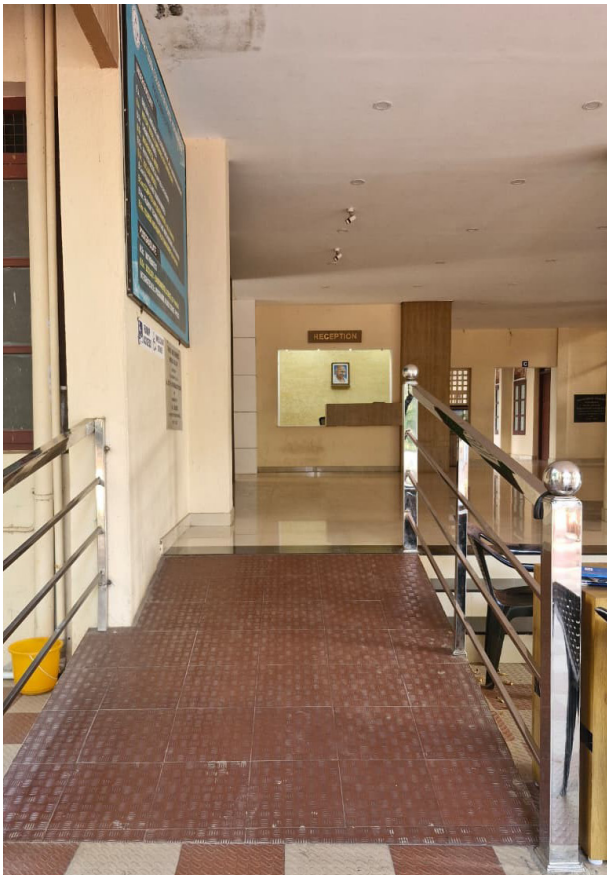


Fig 8.10 Differently able friendly services

8.4.3 Facilities offered in the college

SL NO	FACILITIES OFFER	LOCATION
1	Rails and Ramps	In front of the college, Auditorium
2	Lift	Nil
3	Accessible room	Amenities Room behind Auditorium
4	Emergency exit	Staircases in all corners
5	Transportation	Nil
6	Accessible signages	In front of the college and labs.
7	Scribe and examinations	Made available as per request
8	Essential support room	Gymnasium, Sick room
9	Human assistance	Information desk in the front
10	Electric Examination Table	Nil
11	Wheelchair facilities	Near the reception
12	Fire Exit	Staircases in all corners
13	Sport and game events	Ground

Table 8.4 Campus amenities and supporting services

Fig 8.11 Vehicle parking

8.4.4 Installation of fire extinguishers in various locations

SL. NO	COUNT	CAPACITY	LOCATION
1	3	2 kg each	Auditorium
2	1	4 kg	Auditorium

Table 8.5 Fire extinguisher equipped point

Fig 8.12 Fire extinguisher

8.4.5 Sound recording of the college

Sl No	Location	Sound (in dB)	
		Min	Max
1	Car parking area near to ground	127.07 ± 1.70	1.70± 3.06
2	Near Hostel	136.37± 0.29	199.17± 4.83
3	Near Canteen	138.53± 2.12	214.77±18.18
4	Near freedom wall of auditorium	125.30±1.45	189.17±3.76
5	Near Two-wheeler parking	145.63±11.85	214.07±21.45

Table 8.6 Summary of sound recording analysis

Higher sound recording was notice near two-wheeler parking 145.63±11.85 minimum and 214.07±21.45 maximum. High sound levels in two-wheeler parking areas can occur due to the inherent noise produced by motorcycles and scooters, which caused by louder engines than cars. The lack of trees allows sound to travel unimpeded, while hard surfaces such as concrete can reflect noise, amplifying it further. Additionally, the activity of people in the area, nearby traffic, and potential noise from surrounding environments contribute to an overall increase in sound levels, making the parking area feel particularly loud. Followed by the near canteen, 138.53± 2.12 minimum and 214.77±18.18 maximum can be attributed to several factors, conversations among students, clattering dishes, kitchen equipment, and background music can create a cacophony of sounds. The open layout often found in canteens allows sound to travel freely, further raising the noise level, particularly during peak dining hours. Lower-level sound observed in near auditorium 125.30±1.45mimimum and189.17±3.76 maximum, car parking 189.17±3.76 minimum and 1.70±3.06 maximum. Low sound levels are reported in auditoriums and car parking areas shaded by trees. Due to the natural sound-dampening qualities of trees and the design of these environments. Trees act as effective buffers by absorbing sound energy and blocking noise from surrounding areas, creating a quieter atmosphere. In car parking areas, the enclosed space, combined with tree canopies, helps to reduce noise levels from external sources.

8.5 CONCLUSION

The college must strengthen its health and safety performance through minor yet impactful changes, despite community strengths and financial constraints. While the institution places special emphasis on the physical, medical, and psychological well-being of its community, several critical gaps remain, including the lack of standard signage, adequate parking facilities, and disabled-friendly infrastructure. Priority should be given to upgrading these infrastructure facilities to transform the campus into a fully developed, safe, and accessible environment for all members of the college community. The presence of trees contributes positively by providing natural sound-dampening and acting as effective noise buffers, creating a quieter and more pleasant campus atmosphere. However, emergency fire safety measures are currently limited to the auditorium, with no such facilities reported inside academic buildings. This is a serious concern that requires immediate implementation and regular monitoring. Furthermore, measures must be taken to ensure proper treatment of grey water, along with systematic training for mess and cleaning staff on hygiene practices, periodic maintenance and recording of water sources and fixtures to guarantee water quality, and regular fitness inspections.

8.6 RECOMMENDATION

- Prioritise upgrades to make the campus fully accessible and user-friendly for all community members, especially differently-abled individuals. Install ramps, handrails, accessible toilets, elevators

(where needed), and tactile paving for visually impaired students, following guidelines like India's Harmonised Guidelines for Barrier-Free Built Environment and UGC accessibility standards.

- Display standard signage by installing clear, illuminated directional signs, emergency exit signs, fire safety signs, and universal symbols (e.g., for restrooms, ramps, and first aid) throughout the campus.
- Improve parking facilities by designating and marking accessible parking zones, adding more spaces if needed, and enforcing no-obstruction rules.
- Immediately extend emergency fire safety systems (fire alarms, extinguishers, sprinklers, smoke detectors, and emergency exits) to all academic buildings, labs, hostels, and administrative areas, not just the auditorium.
- Implement a systematic grey water treatment process (e.g., basic filtration and disinfection) for reuse in gardening, flushing, or cooling to promote sustainability and reduce water strain.
- Provide mandatory hygiene and physical appearance training for all mess, cleaning, and maintenance staff, covering food handling, personal hygiene, uniform standards, and cleaning protocols.
- The college hostel upholds the same level of safety and security as the main campus facilities. This includes structured procedures for incident reporting, emergency preparedness and response, accident documentation, prompt medical accessibility, and strict restriction of unauthorised external entry, which is efficiently overseen by the warden.
- Procure commercial LPG cylinders in place of domestic ones and establish a systematic record-keeping and periodic inspection protocol for all LPG connections to eliminate potential fire risks.
- Install protective barriers along both sides of the canal adjacent to the college entrance to prevent accidental falls, and undertake regular chlorination or application of bleaching powder during the monsoon season to minimise slippery surfaces.
- Institute a systematic program for the periodic monitoring, maintenance, and assessment of all water sources and fixtures, right along with water quality, to ensure the provision of safe, potable drinking water and reliable utility water throughout the campus.

8.7 OCCUPATIONAL HEALTH AND SAFETY PLAN

8.7.1 Establish an occupational and safety health management committee

In its commitment to the health and safety of the college community, the institution is establishing a formal Occupational Health and Safety (OHS) program. This program will be structured in accordance with ISO standards and operate under the college's overarching Environmental Management System (EMS). A dedicated committee, consisting of six faculty members and fifteen students, has been appointed to oversee this program. To ensure long-term sustainability and the uninterrupted execution of vital functions such as risk assessment and monitoring, the committee will recruit new members from the first-year student cohort each year. Regular meetings will be held to review progress, manage activities, and provide updates. The committee's primary mandate is to cultivate a campus environment that actively prioritises the health, safety, and well-being of all our students, staff, visitors, and stakeholders.

8.7.2 Implement effective methods to attain the set Objective

- The primary objective of the committee is to enhance health and safety management plan of the organisation. This can be accomplished by developing and implementing comprehensive annual health and safety training programs, conducting regular hazard assessments, and implementing effective risk control measures. Establishing clear emergency response procedures, conducting necessary drills, and providing accessible first-aid and basic healthcare resources on campus are also critical components of this initiative. These activities must be carried out consistently to ensure the safety of all stakeholders within the institution.

8.7.3 Formulating a comprehensive strategy for sustainable energy management

- Ensure effective communication of management responsibilities during Governing Council meetings to implement and approve duties through strategic planning with the Treasurer and Bursar. Additionally, facilitate the communication of management issues to the Principal through formal request letters from the OHS Coordinator.
- Responsibilities for staff will be documented in the college diary, while student responsibilities will be communicated through awareness classes led by the National Service Scheme (NSS) unit. Additionally, signage displaying student responsibilities will be strategically placed around the campus. These responsibilities will be distributed annually to all community members, with the Occupational Health and Safety (OHS) Coordinator ensuring that relevant information is conveyed to the faculty member responsible for maintaining the diary.
- Regular inspections will be conducted to ensure the timely servicing of water purifiers and compliance with food safety protocols in the canteen and hostel mess. Ongoing fumigation and weed clearing will be essential to maintain a safe environment. Any infrastructural maintenance needs should be reported, with additional requirements submitted to the principal.
- The committee will also oversee the reporting and management of any accidents or incidents that occur on campus, ensuring prompt response and follow-up. The OHS team will be tasked with executing emergency responses effectively. In the event of an emergency, the principal will issue a college-wide notification via the public address system, and the OHS team will activate its emergency action plan to safeguard all community members.
- Organise awareness programs focused on health, safety, and disaster management will be integrated into the academic calendar. Responsibilities for these activities will be assigned to various college clubs in collaboration with the OHS committee, as determined by assessments conducted by the OHS Coordinator.

8.7.4 Long term and short term goals

8.7.4.1 Short term goals

- Strengthen the number of fire extinguishers should be instilled in the campus an awareness must be given on how to use it properly.
- Provision of safety equipment in the laboratories is a mandate. Along with this, medical kits must also be made available on every floor of the campus.
- Repair of windows must be ensured in all classrooms, as there is a fear of entry of reptiles.
- During the rainy season, it must be ensured that the interlocks are properly cleaned with anti-slip powders so that no one slips.
- Installation of signage boards wherever necessary.
- Install and maintain prominent signage boards displaying safety measures and designated vehicle parking guidelines.
- Ensure canteen staff consistently wear appropriate protective attire, including caps, gloves, aprons, and any other required uniform or safety gear.

8.7.4.2 Long-term goals

- Repair of the floor on the stage in the auditorium is essential. Using this stage for cultural events poses a potential risk of injury.
- Infrastructural maintenance in the hostel is also essential. Proper planning is required for the same, and a team must be set to take care of necessities in the hostel.
- Improve and scale up facilities and amenities to align with the current and future requirements of individuals with disabilities.
- A properly maintained sick room is also a necessity in terms of occupational health and safety. Such infrastructural development funds for facilities

8.7.5 Establish a robust communication channel

- The OHS Coordinator disseminates all pertinent health and safety information to Department Heads and union representatives. These individuals then

ensure the information is cascaded to the entire college community.

- The primary channel for routine updates is departmental WhatsApp groups, while general instructions are displayed on official notice boards. Communications regarding emergencies will be distributed via a separate, dedicated protocol.

8.7.6 Continuously monitoring and enhancing the system

- Conduct annual risk assessments of campus areas and prepare detailed reports.
- Maintain and regularly update all Occupational Health and Safety (OHS) registers.
- Facilitate monthly meetings to review progress, follow up on action items, and clarify assigned tasks.
- Actively solicit feedback and concerns from the college community through designated communication channels (e.g., a dedicated WhatsApp group).

8.7.7 Conclude and conduct a follow-up on the system

This Occupational Health and Safety plan, aligned with ISO standards and integrated into the college's Environmental Management System, establishes a framework for a safe and healthy campus environment. The plan's emphasis on continuous monitoring, regular reviews, and stakeholder feedback ensures that health and safety remain a priority, showing our commitment to the well-being of students, staff, and visitors.

To ensure the effectiveness of this OHS plan, the following mechanisms have to be implemented:

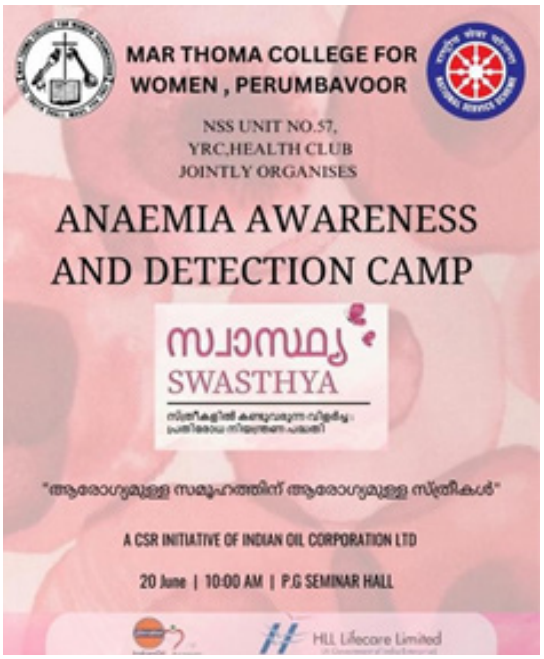
- An annual audit is conducted with the expertise of an independent external body or a designated internal team to identify areas for improvement and verify compliance with OHS standards and regulations.
- A suggestion box has been established for the college community to provide feedback, report concerns, or suggest improvements related to health and safety. The OHS committee will have to go through these monthly and take necessary actions according to the policy.
- The OHS Coordinator communicates to the Principal, Treasurer, and Bursar to allocate a budget for the OHS. This will ensure that adequate funds are there for necessary equipment, training programmes and maintenance of all that is reported.

By following all these, the college can ensure that its Occupational Health and Safety plan remains effective and continuously meets the needs of its community and maintain a secure and healthy environment for all.

8.8 ACITIVITIES CONDUCTED

Anaemia awareness and detection camp - 20 june 2023

Brochure of the program



Program chart

Date	20/06/2023
Time	10.00 A.M.
Welcome Speech	Ms. Melvi Chandy, NSS Programme Officer
Presidential Address	Dr. Sujo Mary Varghese, Principal
Felicitation	Dr. Anupama P.,IQAC Coordinator
	Anaemia Awareness and Detection
Vote Of Thanks	Ms. Reemy Sara Mathai, Health Club Faculty in charge

The Department of Zoology, in association with NSS unit no. 57, YRC (Youth Red Cross) unit no. 10 & Health club, organised an Anaemia Awareness and Detection Camp, named SWASTHYA – An Innovative Nutritional Programme for Women in Reproductive Age on 20th June, 2023. Two forty-three members, including students, teaching and non-teaching staffs were benefited from this.

Evaluation report

Outcome

- Raised awareness about anaemia, including its causes, symptoms, and consequences.
- Educated the community about preventive measures, dietary recommendations, and lifestyle modifications to combat anaemia.
- Provided free screening and detection services to identify individuals at risk of anaemia.
- Offered counselling and guidance to individuals diagnosed with anaemia, emphasising the importance of treatment and management.

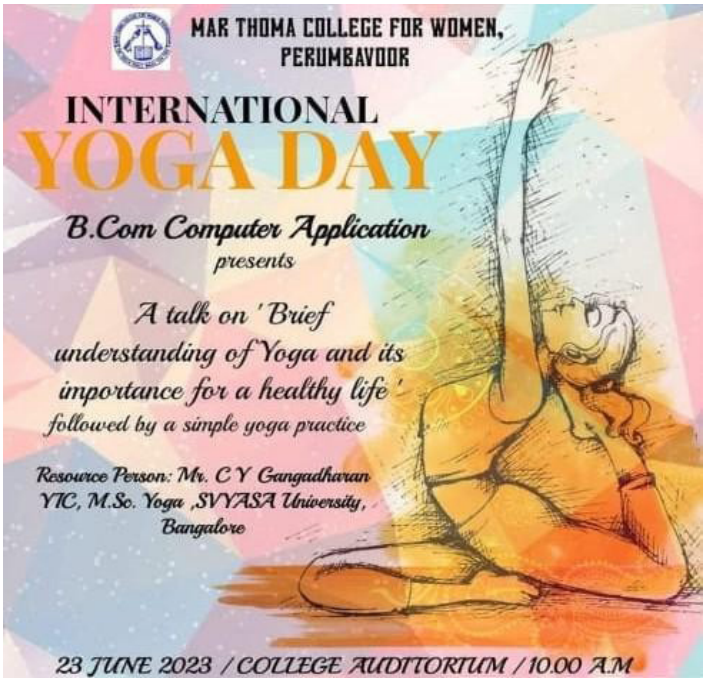
Healthcare personnel conducted free haemoglobin (Hb) level tests and participants were provided with immediate results, and those with low Hb levels were given further consultation by medical experts. Posters and banners were exhibited in the community. Brochures and other informative materials were distributed to participants, containing essential information about anaemia, dietary recommendations, and contact details of local healthcare providers for further assistance.

Income & expense

Nil

International yoga day celebration by commerce computer application - 23 june 2023

Brochure of the program



Program chart

Date & Time	23 June 2023, 10:00 am
Welcome Speech	Ms. Malavika Unni, II B. Com. CA
Presidential Address	Dr.Sujo Mary Varghese, Principal
Session on Yoga and its importance for a healthy life by Mr. C Y Gangadharan	
Vote Of Thanks	Ms. Saritha N., Head of the Department

REPORT

In commemoration of International Yoga Day, the Department of commerce computer application organized a yoga session on 23 June 2023, expertly led by Mr. C.Y. Gangadharan, YIC, SVASYA University, Bangalore. The event aimed to promote awareness about the benefits of yoga and encourage students to incorporate it into their daily lives.

EVALUATION REPORT

Outcome

The yoga session proved to be a resounding success, with students expressing a deep sense of relaxation and rejuvenation. The event helped foster a greater appreciation for the ancient practice of yoga, encouraging students to adopt it as a valuable tool for maintaining overall well-being.

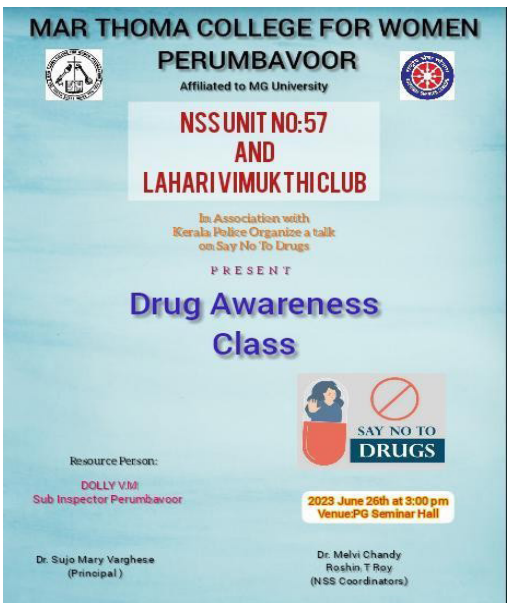
Impact

The experience through a series of yoga asanas, rejuvenate everyone's mind and body. The session was catered to participants of all skill levels, ensuring a comfortable and enjoyable experience for all.

INCOME & EXPENSE

Refreshment for Resource Person : Rs. 30/-

International drug awareness day - 26 june 2023 brochure of the program



program chart

Date & Time	26 June 2023, 11:30 am
NSS Song	Choir
Welcome Speech	Ms. Fathima V. M. , NSS Volunteer Secretary
Keynote Address	Mr. Dolly V. M., Sub Inspector of Police
Discussion	
Vote Of Thanks	Ms. Reshma Chandran, NSS Volunteer

REPORT

On 26th June 2023, the NSS Unit of our college and the Lahari Vimukthi Club, in collaboration with the Kerala Police, organized a drug awareness class aimed at educating students about the dangers of substance abuse. The event featured Mr. Dolly V M, Sub Inspector of Police, Perumbavoor, as the resource person.

EVALUATION REPORT

Outcome:

The session was attended by a significant number of students and faculty members. Mr. Dolly V M provided valuable insights into the legal, social, and health consequences of drug use, and emphasized the role of youth in combating drug abuse. Interactive discussions and real-life examples enhanced participant engagement.

Impact:

The awareness program successfully sensitized students about the harmful effects of drugs and encouraged them to stay away from addictive substances. It also fostered a sense of social responsibility and empowered students to be ambassadors of a drug-free society.

INCOME AND EXPENSES

Nil

Team building and general orientation programme on disaster

Management – 19 july 2023

Brochure of the program

PROGRAM CHART

Date & TIme	19 July 2023, 1:30 pm
NSS Song	Choir
Welcome Speech	Nanda Anish, NSS Volunteer
Keynote Address	Mr. Aravind Sajeevan , Senior Training Instructor, Team Kerala Youth Force
Training Session by Mr. Bibine Ouseph, Training Instructor, Team Kerala Youth Force	
Vote Of Thanks	Ms. Arya P. Krishnan, NSS Volunteer

REPORT

On 19th July 2023, the NSS Unit No. 57 of Mar Thoma College for Women, Perumbavoor, in collaboration with the Kerala Youth Welfare Board, organized a Team Building and General Orientation Programme for the Team Kerala Youth Force. The session focused on Disaster Management and was led by Mr. Aravind Sajeevan, Senior Training Instructor, and Mr. Bibin Ouseph, Training Instructor of Team Kerala Youth Force.

EVALUATION REPORT

Outcome:

The programme included engaging activities and informative sessions that equipped participants with essential knowledge and skills related to team building and effective disaster response. The instructors provided practical insights and interactive training on handling emergencies.

Impact:

The orientation helped enhance the leadership qualities, coordination skills, and disaster preparedness of the participants. It fostered a spirit of teamwork and civic responsibility among the youth, preparing them to respond proactively during crisis situations.

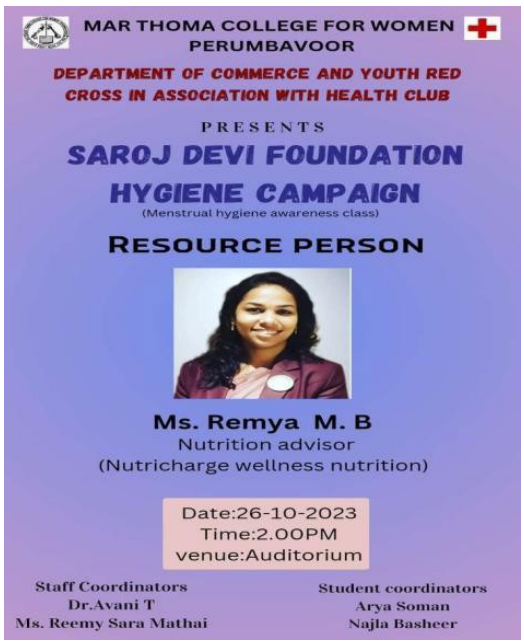
INCOME AND EXPENSES

Nil

Health and hygiene campaign - 26 october 2023

Brochure of the program

Program chart



Date & Time	26 October 2023, 2:00 pm
Welcome Speech	Ms. Arya Soman, SUO, Student Coordinator
Presidential Address	Dr.Sujo Mary Varghese, Principal
Felicitation	Ms. Reemy Sara Mathai, Health Club Faculty in charge
Saroj |Devi Foundation Hygiene Campaign by Ms. Remya M. B., Nutrition Advisor	
Vote Of Thanks	Dr. Avani T., YRC Faculty in charge

REPORT

The department of zoology in collaboration with department of commerce and Youth Red Cross in association with Health club conducted SAROJ DEVI FOUNDATION HYGEINE CAMPAIGN on 26 December 2023 at 2 PM. Ms. Remya M. B, Nutrition advisor was the resource person of the program. The program was conducted to empower students totake control of their own health and to make feel confident about managing their menstruation. This program created awarness about the importance of their own health and hygeine.

EVALUATION REPORT

Outcome

Empowered students to take control of their health ang hygiene and made them confident about managing their menstruation.

Impact

Created awareness about the importance of one selves health and hygiene

INCOME & EXPENSES

Refreshment for Resource Person : Rs. 40/-

Kakkarasi nadakam"as part of aids awareness campaign –

29 NOVEMBER 2023

BROCHURE OF THE PROGRAM

PROGRAM CHART

Date & TIme	29 November 2023, 9:30 am
NSS Song	Choir
Welcome Speech	Dr. Melvi Chandy, NSS Programme Officer
Principal's Remarks	Dr. Sujo Mary Varghese
	Performance of Kakkarissi Nadakam
Vote Of Thanks	Ms. Angel P. M., NSS Volunteer

REPORT

On 29th November 2023, the NSS Unit of our college, in collaboration with the Kerala AIDS Control Society and Taluk Headquarters Hospital, Perumbavoor, organized a "Kakkarasi Nadakam" in the college campus to raise awareness about AIDS and promote healthy practices among students.

EVALUATION REPORT

Outcome:

The traditional folk art form "Kakkarasi Nadakam" was effectively used to convey messages about HIV/AIDS prevention, stigma reduction, and the importance of regular testing and safe behavior. The performance attracted wide student participation and created a lively, engaging environment.

Impact:

The creative and culturally relevant approach significantly improved awareness and understanding of AIDS-related issues among the audience. The event played a key role in breaking myths and encouraging open discussions on the topic, fostering a more informed and empathetic student community.

INCOME AND EXPENSES

Nil

Session on emotional well-being – 7 february 2024

Brochure of the program

Program chart

Date & TIme	7 February 2024, 3:30 pm
NSS Song	Arafy and Khadeeja
Welcome Speech	Devika Vijayan, NSS Volunteer
Keynote Address	Dr. Sijiya Binu, Chairperson, Athma Foundation
Discussion	
Vote Of Thanks	Anuja M. R., NSS Volunteer

REPORT

On 7th February 2024, the NSS Unit of our college, in association with the Department of English and SCM, Kerala Region, organized a thought-provoking session on emotional well-being. The initiative aimed to promote mental health awareness and encourage positive coping mechanisms among students.

EVALUATION REPORT

Outcome:

Dr. Sijiya Binu, Chairperson of Athma Foundation, delivered an insightful and engaging talk focused on emotional health, practical strategies to handle stress, and the importance of building a supportive community. The session saw active participation from students and faculty members.

Impact:

The session played a crucial role in initiating meaningful conversations about mental health. It helped students recognize the importance of emotional well-being, equipped them with helpful strategies to manage stress, and contributed to creating a more compassionate and understanding campus environment.

BUDGET

Income: Fund for Regular Activities provided by MHRD Disaster Management Training:1000
Remuneration to Resource Person: 1500
Expense
Session on Disaster Management - TA: 1000
Session on Emotional Well-being- Remuneration: 1500

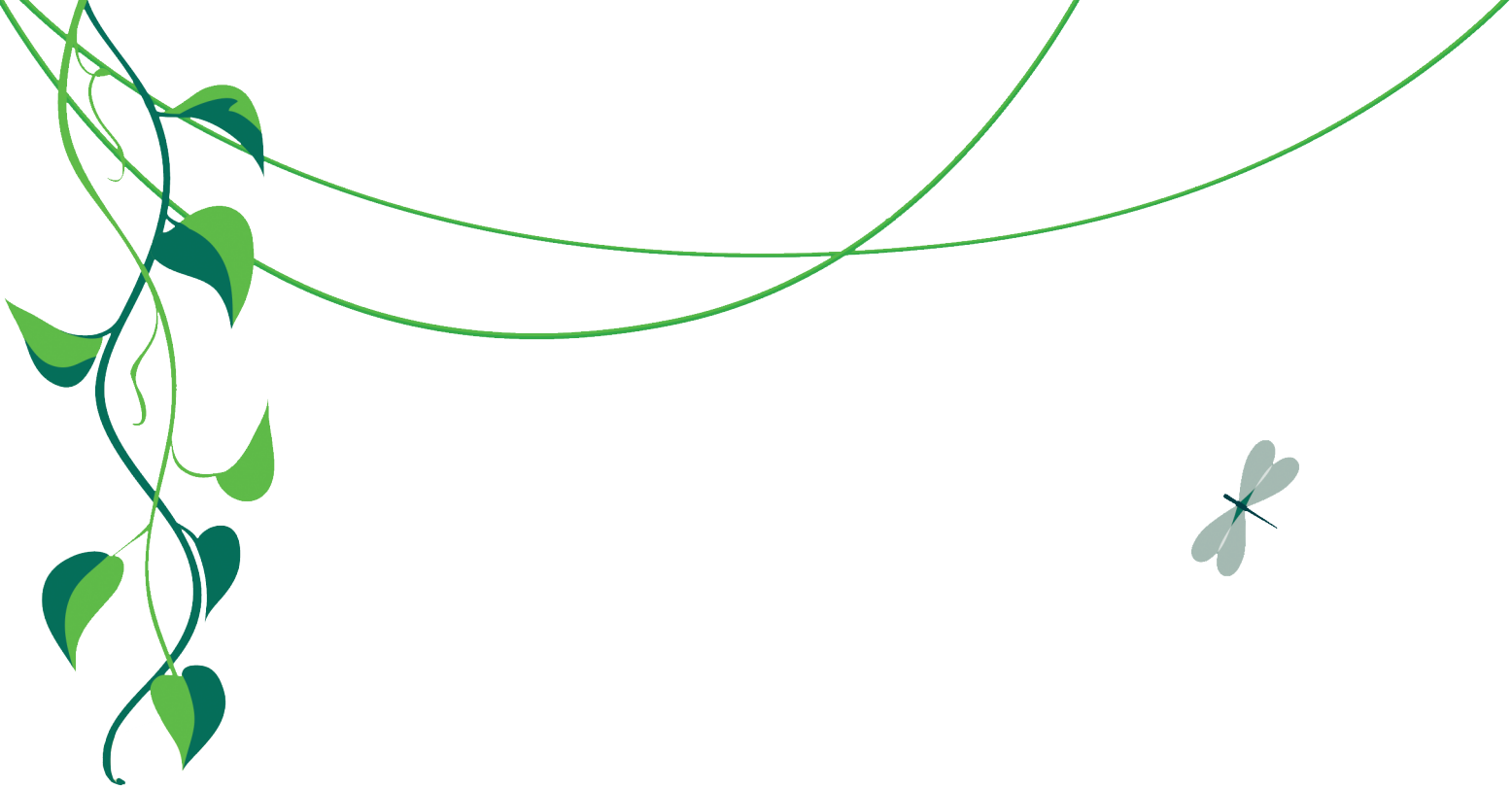
Chapter IX

CARBON FOOT PRINT : AUDIT REPORT

TIES

MAR THOMA COLLEGE FOR WOMEN PERUMBAVOOR

THE TRUTH SHALL MAKE YOU FREE



Sustainable Development is the pathway
to the future we want for all it offers
a framework to generate economic growth
achieve social justice, exercise, environmental
stewardship, and strengthen governance

- Ban Ki - Moon

9

Carbon Foot Print

9.1 COMPREHENSIVE CARBON FOOTPRINT AND ECOLOGICAL ASSESSMENT

Executive Summary

The transition of higher education institutions toward climate neutrality represents a critical vector in global greenhouse gas mitigation strategies and sustainable development. This comprehensive assessment provides an exhaustive evaluation of the carbon footprint, energy management protocols, waste circularity, and ecological biodiversity of Marthoma College, Perumbavoor, Kerala. This report leverages empirical data spanning electrical consumption, fossil fuel utilization, waste generation matrices, water discharge profiles, and highly detailed floristic biomass inventories.

The analytical synthesis reveals a heavily optimized operational profile characterized by significant investments in renewable energy infrastructure and aggressive shared mobility policies. The institution generates a baseline Scope 1 and Scope 2 emissions footprint of approximately 36.39 metric tonnes of carbon dioxide equivalent annually. However, this operational footprint is substantially offset by a robust 35-kilowatt solar photovoltaic installation that mitigates an estimated 25.65 metric tonnes of carbon dioxide equivalent per year, alongside a rich floristic inventory of 101 surveyed mature trees providing a standing biological carbon sink of approximately 3.03 metric tonnes of carbon dioxide equivalent annually. Consequently, the net operational carbon footprint of the campus is remarkably low, standing at approximately 7.71 metric tonnes of carbon dioxide equivalent.

Furthermore, the integration of shared mobility protocols among staff and students has resulted in massive cumulative avoided emissions, emphasizing the institution's broader socio-environmental impact beyond its immediate geographic boundary. Despite these profound successes, systemic vulnerabilities exist within the campus's circular economy framework—specifically, the non-functional state of the hostel's biogas plant and the heavy concentration of unmanaged biowaste generated by the

canteen.1 Rectifying these waste management deficits, coupled with marginal expansions in renewable energy capacity and targeted understory biodiversity enhancements, positions Marthoma College highly favorably to achieve absolute net-zero operational emissions in the immediate near term.

9.1.1 Institutional Context and the Imperative for Climate Action

As global climate paradigms shift toward mandatory decarbonization, educational institutions occupy a unique socio-technical niche. They serve not only as concentrated hubs of resource consumption, localized traffic generation, and waste production but also as living laboratories for sustainable development, ecological conservation, and environmental stewardship. Marthoma College operates within the ecologically sensitive landscape of Kerala, a state uniquely vulnerable to climatic shifts, hydrological variations, and biodiversity loss, which has prompted regional governmental bodies to set aggressive targets to transform the region into a carbon-neutral state by 2050.

The imperative to rigorously quantify the carbon footprint of the campus aligns with broader international frameworks, including the Greenhouse Gas Protocol and ISO 14064 standards for greenhouse gas accounting, as well as the specialised green auditing protocols pioneered by regional bodies such as the Tropical Institute of Ecological Sciences. The green audit mechanism systematically identifies, quantifies, records, and analyses the components of environmental diversity and resource utilisation. It is an essential component of the National Assessment and Accreditation Council framework, specifically addressing Criteria 7 regarding institutional values and best practices. By transforming abstract operational data such as utility bills, fuel logs, and waste manifests into standardised carbon equivalents, the institution can baseline its performance, identify systemic inefficiencies, and deploy highly targeted decarbonization interventions.

This assessment transcends a mere arithmetic aggregation of emissions. It undertakes a systemic analysis of the institution's energy-water-waste nexus. It explores the causal relationships between infrastructure design and actual energy draw, the spatial distribution of waste fractions across different campus zones, and the micro-ecological health of the campus as indicated by taxonomic abundance and the Simpson Diversity Index. The ultimate objective is to provide a nuanced, data-driven foundation that empowers the college administration to implement high-impact, cost-effective sustainability strategies that resonate with both local ecological needs and global climate imperatives.

9.1.2 Carbon Accounting Framework and Boundary Delineation

To ensure scientific rigour and strict adherence to international carbon accounting standards, this assessment categorises the institution's environmental impact across three distinct operational boundaries. This categorisation mirrors standard global protocols, ensuring that direct emissions, indirect energy emissions, and broader value-chain impacts are disaggregated and analysed with the appropriate methodological rigour.

The first boundary encompasses direct greenhouse gas emissions originating from sources that are directly owned or controlled by the institution. For Marthoma College, this encompasses the stationary combustion of high-speed diesel fuel in backup power generators and the utilisation of Liquefied Petroleum Gas in localised thermal applications, such as laboratories or commercial kitchens. These are emissions where the physical chemical combustion occurs directly on the campus premises.

The second boundary accounts for indirect emissions generated off-site but directly attributable to the institution's consumption of purchased electricity. This is calculated based on the draw from the Kerala State Electricity Board

grid. The carbon intensity of this electrical draw is heavily dependent on the regional grid mix, which dictates how much coal, gas, hydro, or solar power is utilised by the utility to generate the electricity consumed by the campus.

The third boundary models all other indirect emissions occurring within the institution's value chain, representing impacts where the institution has influence but not direct control. This assessment models these impacts derived from solid waste generation across various categories including plastic, paper, bio-waste, chemical, and e-waste, while also assessing the massive avoided emissions achieved through shared commutation practices.

The conversion of raw activity data into standard Carbon Dioxide Equivalents requires the application of highly specific, localised emission factors. The Central Electricity Authority of India continuously updates the emission factors for the Indian power grid to reflect the increasing integration of renewable energy sources. For the 2024–2025 temporal boundary, a conservative grid emission factor of 0.736 kilograms of carbon dioxide equivalent per kilowatt-hour is utilised to reflect the current decarbonization trajectory of the national grid. The combustion of high-speed diesel in generators yields an emission factor of 2.6444 kilograms of carbon dioxide equivalent per litre, accounting for the chemical oxidation of the fuel's carbon content. Liquefied Petroleum Gas combustion is assessed at a standardised emission factor of 2.983 kilograms of carbon dioxide equivalent per kilogram of gas consumed, representing the complete stoichiometric combustion of the propane and butane mixture.

9.1.3 Analysis of Direct Greenhouse Gas Emissions

The operational resilience of modern educational infrastructure relies heavily on backup power generation to ensure pedagogical continuity during grid outages, alongside thermal fuels for specific infrastructural needs such as food preparation or chemical laboratory work. The primary data provided by Marthoma College indicates two specific continuous fossil fuel streams that constitute the institution's direct emissions profile.

The institution procured a total of 14 Liquefied Petroleum Gas cylinders annually, which translates to an estimated mass of 71 kilograms of fuel. Liquefied Petroleum Gas is a highly calorific fossil fuel, and its combustion releases direct carbon dioxide into the immediate atmosphere. Applying the specific emission factor of 2.983 kilograms of carbon dioxide equivalent per kilogram, the annual thermal emissions equate to 211.79 kilograms of carbon dioxide equivalent. This relatively low volumetric figure suggests that the fuel is utilised sparingly. Its use is probably restricted to specific chemistry or biology laboratory applications, or minor auxiliary heating in staff pantries, rather than continuous commercial-scale thermal loads for the entire student body. The minimal reliance on this fuel is a positive indicator of electrification within the campus's thermal systems.

The second component of the direct emissions profile relates to stationary diesel combustion. The operation of the 30-kilowatt localized backup generator required 453.2 liters of high-speed diesel in the 2023-2024 financial year, a figure which escalated to 480.7 liters in the 2024-2025 financial year. This continuous reliance on diesel generation points to the operational necessity of bridging gaps in grid reliability. The nearly six per cent year-over-year increase in fuel consumption suggests either a higher frequency of rolling blackouts from the state grid or extended operational hours for special campus events and administrative functions requiring continuous, uninterrupted power supply.

Utilising the most recent data point of 480.7 liters and applying the standardised emission factor of 2.6444 kilograms of carbon dioxide equivalent per liter, the operation of the generator contributes 1,271.16 kilograms of carbon dioxide equivalent annually. While diesel generators are ubiquitous in Indian institutional settings, they represent a highly carbon-intensive and highly polluting

form of energy generation, releasing not just greenhouse gases but localised particulate matter and nitrogen oxides that impact campus air quality.

The aggregation of direct fossil fuel combustion results in an annual localised footprint of 1,482.95 kilograms of carbon dioxide equivalent, or approximately 1.48 metric tonnes. While this represents a small fraction of the overall institutional footprint, it is a category of emissions that is entirely within the control of the administration to mitigate through the eventual transition to battery energy storage systems or the expansion of the existing solar microgrid.

9.1.4 Indirect Emissions and Electrical Infrastructure Diagnostics

Energy consumption from the regional power grid invariably represents the most significant continuous environmental impact of any large educational facility. The evaluation of grid electrical consumption at Marthoma College presents a multifaceted dataset. The college provided multiple assessment modes for its electrical footprint, which require careful reconciliation to establish an accurate, verifiable emissions baseline.

Assessment Mode	College Consumption/year (kWh)	Hostel Consumption/year (kWh)	Total Campus Consumption (kWh)
Infrastructure Assessment	290,940.33	13,077.48	304,017.81
Mandatory Audit	3,396.00	1,611.00	5,007.00
KSEB Bill Analysis	36,221.33	11,211.00	47,432.33
Energy Meter Reading Sample	11,655.00	6,283.33	17,938.33

Table 1: Comparative Analysis of Electrical Data Streams.

A critical second-order insight emerges from the stark disparity between the "Infrastructure Assessment" of 304,017.81 kilowatt-hours and the "KSEB Bill Analysis" of 47,432.33 kilowatt-hours. The infrastructure assessment essentially quantifies the connected load. This represents a theoretical maximum energy draw, calculated by summing the wattage of every single electrical fixture, heating, ventilation, and air conditioning unit, lighting array, ceiling fan, and piece of laboratory equipment, and assuming they all operate simultaneously at peak capacity for standard working hours throughout the academic year.

The fact that actual billed consumption, derived from the state electricity board data, is merely 15.6 per cent of the theoretical connected load indicates two highly positive operational realities. First, it suggests a robust diversity factor; systems are utilised sporadically, sequentially, and only as required by the occupancy of specific rooms. Second, it highlights highly effective behavioural energy management among the academic staff and student body. High disparities between connected load and actual draw routinely point to disciplined adherence to switching off phantom loads, idle equipment, and lighting in unoccupied lecture halls.

For the purpose of strict carbon accounting, the actual billed consumption must be utilised, as it represents the true physical draw of electrons from the state grid. The total annual grid draw stands at 47,432.33 kilowatt-hours. Applying the 2024-2025 Indian grid emission factor of 0.736 kilograms of carbon dioxide equivalent per kilowatt-hour 11, the total indirect electrical emissions amount to 34,910.20 kilograms of carbon dioxide equivalent, or 34.91 metric tonnes. This constitutes the vast majority of the gross operational footprint, underscoring the critical importance of the institution's renewable energy investments.

9.1.5 Renewable Energy Integration and Solar Photovoltaic Diagnostics

Marthoma College operates a 35-kilowatt capacity grid-tied solar photovoltaic array, representing a major structural commitment to decarbonization and energy independence. Telemetry data extracted from the system's inverter statistics for the year 2025 outlines the generation curve across nine months, providing high-resolution insight into the system's efficiency and mitigating impact.

Month (2025)	PV Production (DC) (MWh)	System Production (AC) (MWh)
January	3.39	3.39
February	3.25	3.25
March	3.10	3.10
April	3.25	3.25
May	2.71	2.71
June	2.65	2.65
July	1.91	1.91
August	2.16	2.16
September	3.72	3.72
9-Month Total	26.14	26.14

Table 2: Solar Photovoltaic System Inverter Output Data.

The temporal variance in solar production perfectly maps to the meteorological and climatological reality of the region. The sharp decline in generation during June, dropping to 2.65 megawatt-hours, followed by July at 1.91 megawatt-hours, and August at 2.16 megawatt-hours, correlates directly with the onset and peak of the Southwest Monsoon season in Kerala. During this prolonged period, heavy, persistent cloud cover and intense precipitation significantly attenuate direct solar irradiance, reducing the photoelectric conversion efficiency of the silicon panels. Conversely, clear-sky months like January, which produced 3.39 megawatt-hours, and September, which produced a peak of 3.72 megawatt-hours, showcase the system's maximum potential when atmospheric interference is minimal.

The absolute parity between direct current production and alternating current production in the dataset implies highly efficient inverter conversion rates with negligible clipping losses or thermal derating. To calculate the annual carbon offset, the nine-month total of 26.14 megawatt-hours, or 26,140 kilowatt-hours, must be annualised to account for the missing autumn and winter months. Extrapolating this average monthly yield over a full twelve-month cycle establishes an estimated annual production of 34,853.33 kilowatt-hours.

By generating this clean power on-site, the college directly displaces equivalent fossil-heavy generation from the regional grid. Applying the grid emission factor of 0.736 kilograms of carbon dioxide equivalent per kilowatt-hour, the annual solar offset equates to 25,652.05 kilograms of carbon dioxide equivalent avoided. This is a profound institutional achievement. The solar array single-handedly offsets 73.4 per cent of the institution's entire indirect electrical emissions, drastically decoupling the college's academic operations from the carbon intensity of the state power sector.

9.1.6 Value Chain Impacts and Waste Circularity

The generation, handling, and ultimate disposal of solid waste create complex emission pathways that ripple throughout the institutional value chain. When organic waste decomposes in anaerobic landfill conditions, it generates methane, a potent greenhouse gas with a global warming potential approximately twenty-eight times greater than carbon dioxide over a century-long timeframe.16 Conversely, the improper disposal or incineration of plastic waste releases both dense carbon matrices and highly toxic atmospheric pollutants.18 Assessing the spatial distribution of this waste is critical for developing targeted mitigation strategies.

Waste Typology	Hostel Generation (kg)	Office Generation (kg)	Campus Generation (kg)	Canteen Generation (kg)	Total Annual Mass (kg)
Plastic Waste	261.47	0.00	0.00	478.84	740.31
Paper Waste	139.31	42.82	141.89	0.00	324.02
Bio-waste	796.11	126.73	281.43	960.17	2,164.44
Chemical Waste	0.00	0.00	25.12	0.00	25.12
Electronic Waste	0.00	0.90	0.00	0.40	1.30
Miscellaneous	0.00	1.00	0.00	0.00	1.00

Table 3: Annual Spatial Distribution and Typology of Solid Waste.[1]

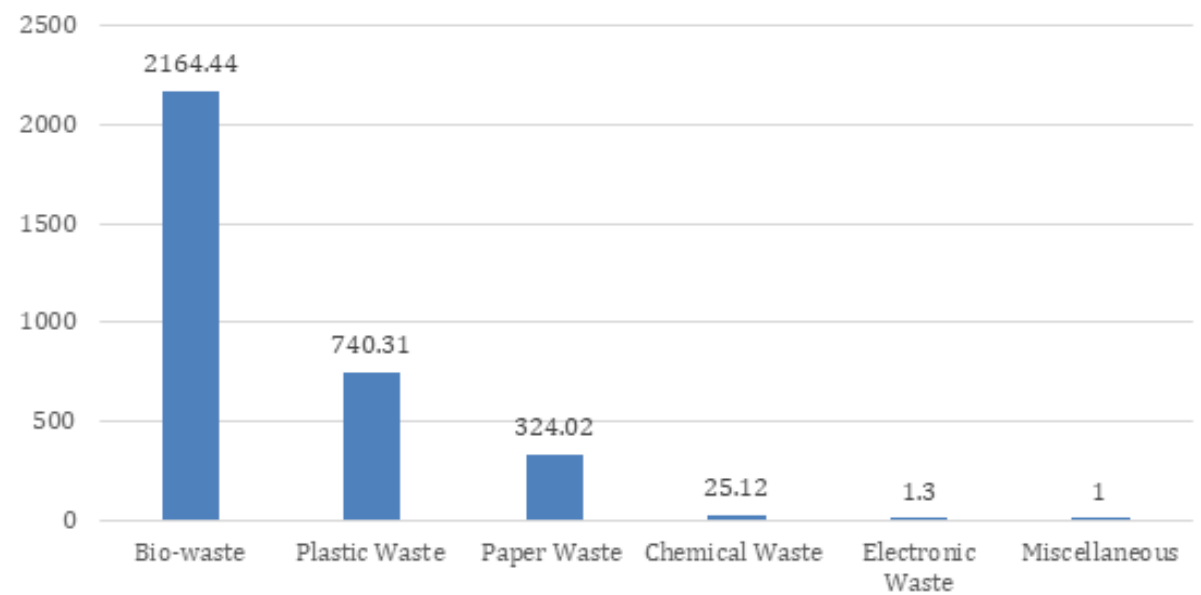


Fig. 1. Annual Solid Waste Generation by Typology (kg)

The spatial disaggregation of the waste data identifies the canteen as the epicenter of the campus's material footprint. The canteen alone generates 64.6 per cent of the campus's total plastic waste, amounting to 478.84 kilograms, and 44.3 per cent of its bio-waste, totaling 960.17 kilograms. This extreme concentration clearly identifies the canteen's procurement supply chain and daily operations as the primary intervention point for sustainability efforts. The massive volume of plastic suggests a heavy reliance on single-use packaging, disposable cutlery, or polyethene wrapping. Transitioning the canteen to biodegradable serving materials, alongside the implementation of strict food-waste minimisation protocols, would drastically shrink the campus's downstream environmental impact.

The production of 25.12 kilograms of chemical waste, sourced entirely from the campus laboratories, and 1.3 kilograms of electronic waste requires highly specialised downstream processing. Electronic waste, though negligible in physical mass, contains heavy metals such as lead and cadmium, alongside persistent organic pollutants that require careful dismantling. Chemical effluent, if improperly neutralised or allowed to enter municipal wastewater streams, poses severe aquatic toxicity risks. Strict adherence to Extended Producer Responsibility frameworks for electronic waste and rigorous neutralisation protocols for laboratory chemicals is mandatory to prevent ecotoxicological damage.

The most critical infrastructural deficit identified within the audit pertains to organic waste management. The data explicitly notes the presence of a 200-liter biogas plant situated at the hostel, which is currently documented as "not functioning". From a carbon accounting and circular economy perspective, this failure represents a significant missed opportunity. The campus generates a total of 2,164.44 kilograms of bio-waste annually. When diverted to an unmanaged municipal landfill or open dump, this dense organic matter undergoes methanogenesis. Assuming a standard methane correction factor and degradable organic carbon fraction based on Intergovernmental Panel on Climate Change methodologies for unmanaged disposal sites, this volume of bio-waste contributes approximately 606 kilograms of carbon dioxide equivalent to the atmosphere through fugitive methane emissions.

If the existing biogas infrastructure were rehabilitated and optimally utilised, it would serve a dual decarbonization function. Firstly, it would intercept the organic waste before it reaches the landfill, eliminating the fugitive methane emissions by capturing the gas in a closed anaerobic digestion system. Secondly, the captured biomethane could be piped directly to the hostel or canteen kitchens, directly displacing the need for commercial Liquefied Petroleum Gas. Given that the hostel and canteen combined produce over 1,750 kilograms of bio-waste, a functional continuous-feed biogas digester could theoretically replace the entirety of the campus's 71-kilogram Liquefied Petroleum Gas consumption. This intervention alone would erase the direct thermal footprint while simultaneously mitigating value-chain methane, representing the highest return-on-investment sustainability action available to the facility management team.

9.1.7 Sustainable Mobility and Avoided Emissions Modelling

Transportation and daily commuting traditionally comprise a massive percentage of an educational institution's broader environmental footprint, often dwarfing the emissions generated by the buildings themselves. However, Marthoma College has catalysed an aggressive behavioural shift toward shared mobility and optimised transit networks among its stakeholders.

The audit data reveals that the optimisation of vehicular transit specifically the use of eleven four-wheelers, including two designated shared vehicles, and thirty-four two-wheelers, including three shared vehicles, has resulted in extraordinary cumulative fuel savings. The institution reports an estimated fuel savings of 120,200 liters attributed to the four-wheeler network and 7,212 liters attributed to the two-wheeler network, resulting in a staggering total of 127,412 liters of saved fossil fuel.

While it is highly probable that this massive figure represents a cumulative multi-year savings calculation, or aggregates the avoided fuel consumption against a theoretical baseline of single-occupancy vehicle commutes mapped over millions of cumulative passenger-kilometres, the carbon implications are profound. Applying an average mobile combustion emission factor for conventional internal combustion engines, which ranges from approximately 2.3 kilograms

of carbon dioxide equivalent per liter for standard petrol to 2.64 kilograms for diesel, the mitigation achieved through these shared mobility frameworks can be accurately quantified.

Calculating this based on the standard diesel emission factor of 2.6444 kilograms of carbon dioxide equivalent per liter, the avoided carbon footprint equates to 336,923.3 kilograms of carbon dioxide equivalent, or approximately 336.9 metric tonnes avoided. This mechanism of avoided emissions is technically kept separate from the direct operational greenhouse gas inventory to adhere strictly to accounting protocols and prevent double-counting. Nevertheless, it demonstrates that the institution's policies and the community's willingness to embrace carpooling and shared transit are actively pulling vast amounts of carbon out of the regional transportation sector. It highlights the immense power of structural behavioural incentives over purely technological fixes, proving that mobility as a service, even on a localised institutional scale, yields massive environmental dividends.

9.1.8 Water Efficiency and the Water-Energy Nexus

Water consumption is inextricably linked to energy consumption within institutional infrastructure. The extraction of groundwater, its purification, its distribution across a multi-story campus, and the eventual treatment of the wastewater all require substantial continuous electrical loads, creating a hidden carbon footprint often termed the water-energy nexus. Understanding spatial water use is critical for driving down the indirect electrical footprint of the campus's booster pumps.

A manual discharge study was conducted across various building elevations to assess flow rates, usage patterns, and potential water wastage across the campus topography.

Building Sector / Elevation	Annual Manual Discharge (Liters)	Average Usage Metric
Hostel Facilities	216.12	0.42
Ground Floor Areas	307.36	0.59
Middle Floor Areas	84.88	0.16
Top Floor Areas	75.12	0.14
Outside / Grounds	534.69	1.03

Table 4: Spatial Distribution of Water Discharge.

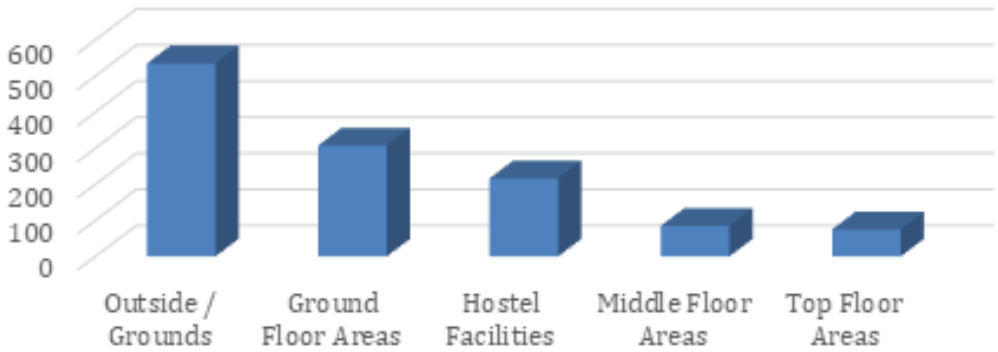


Fig.2. Spatial Distribution of Water Discharge (Liters)

The gravitational physics of standard plumbing systems dictate that pumping water to higher elevations demands exponentially more electrical energy to overcome hydrostatic head pressure. The empirical data indicate that water discharge is highest on the ground floor and outside areas, and systematically decreases at higher elevations, reaching its lowest point on the top floor. 1 From an energy management perspective, this is an optimal distribution. Minimising water utilisation on higher floors directly reduces the continuous electrical load on the campus's transfer pumps, subsequently lowering the Scope 2 electrical footprint.

The notably high outside discharge of 534.69 liters is almost certainly attributed to landscape irrigation and the maintenance of the campus's extensive gardens and arboreal assets. While maintaining green infrastructure is vital for ambient cooling and biodiversity, utilising highly purified potable water for horticulture represents an inefficiency. Implementing smart drip irrigation systems or rerouting treated greywater from the hostel washrooms for landscape use could further decouple the campus's botanical health from its freshwater extraction demands, yielding simultaneous water and energy conservation benefits.

9.1.9 Ecological Auditing: Faunal Diversity and the Simpson Index

A hallmark of a truly sustainable campus is the preservation, integration, and enhancement of complex micro-ecosystems within the built environment. The ecological health of Marthoma College was rigorously quantified through faunal surveys utilising the Simpson Diversity Index, a mathematical measure that characterises species diversity in a community by accounting for both the richness of species and the evenness of their abundance. Index values range from zero, indicating no diversity or a monoculture, to approaching one, indicating infinite diversity and perfect ecological balance.

Taxonomic Category	Recorded Abundance	Simpson Diversity Index
Avifauna (Birds)	18	0.46
Odonata (Dragonflies)	12	0.07
Lepidoptera (Butterflies)	21	0.09
Reptilia (Reptiles)	6	0.00
Arboreal Flora (Trees)	44	0.03
Herbaceous Flora (Herbs)	56	0.04
Shrubbery (Shrubs)	28	0.04
Mammalia (Mammals)	5	0.00
Heterocera (Moths)	32	0.04

Table 5: Faunal and Floral Abundance and Diversity Metrics.

The data reveal that the avifauna present the highest micro-ecological stability within the campus boundaries, with eighteen distinct species yielding a Simpson Index of 0.46. This robust figure suggests that the campus provides adequate mature canopy cover, secure nesting sites, and diverse foraging opportunities to support a healthy, varied bird population. However, the index plunges to zero for both reptiles and mammals. This extreme lack of diversity is highly characteristic of fragmented urban or semi-urban institutional landscapes where continuous wildlife corridors have been severed by roads, fencing, and concrete infrastructure, preventing the movement and habitation of ground-dwelling fauna. Furthermore, the very low indices for critical pollinator species such as butterflies, dragonflies, and moths indicate a potential lack of specific nectar-bearing host plants or an understory that is overly manicured. Enhancing understory complexity by allowing specific zones of herbs and shrubs to grow wilder, and strictly minimising the use of chemical pesticides, can help elevate the diversity indices for these vital insect taxa, restoring a more complex trophic web within the college grounds.

9.1.10 Floristic Inventory and Biological Carbon Sequestration

TreesTrees represent the most effective and easily verifiable terrestrial carbon sinks, biologically stripping carbon dioxide from the atmosphere via photosynthesis and sequestering the carbon in their dense lignocellulosic biomass, which comprises their trunks, branches, and deep root systems. The green audit meticulously inventoried one hundred and one individual trees across forty-four distinct scientific taxa.

The carbon sequestration rate of a tree is not uniform; it is dictated by the specific species' cellular wood density, its allometric growth patterns, its maximum canopy volume, and the localised sub-humid tropical climate of Kerala, which generally accelerates biological biomass accumulation compared to temperate or arid zones due to high annual rainfall and continuous solar radiation. An analysis of the specific species present on the Marthoma College campus reveals a highly effective, multifaceted biological sink.

The campus hosts high-biomass tropical species that act as the heavy lifters of the biological carbon sink. The inventory includes five Artocarpus heterophyllus, commonly known as Jackfruit trees, and fourteen Cocos nucifera, or Coconut palms. Jackfruit trees are exceptional carbon sinks due to their massive structural girth, broad evergreen canopies, and incredibly dense wood, capable of sequestering up to 50 kilograms of carbon dioxide equivalent annually once mature. Similarly, mature coconut palms in tropical climates, with their rapid vertical growth and dense fibrous trunks, are documented to sequester between 37 and 56 kilograms of carbon dioxide equivalent annually, providing a massive continuous sink.

The inventory also notes the presence of premium timber and expansive canopy species, including three Azadirachta indica (Neem) and two Swietenia macrophylla (Mahogany) trees. Neem is globally renowned for its rapid growth in varied soils and its vast canopy architecture, which not only provides immense shade but sequesters approximately 20 to 30 kilograms of carbon dioxide equivalent per year. Mahogany is a premium tropical hardwood; its high cellular density means that while its volumetric growth may appear moderate compared to softer woods, its actual carbon storage per cubic meter is immense. A healthy mahogany tree can capture upwards of 25 to 60 kilograms of carbon dioxide equivalent annually, depending on its age and the specific edaphic conditions. The presence of Xylia xylocarpa (Burmese Ironwood) and Hopea parviflora further adds to this dense timber sink, as these species lock away carbon in highly durable, rot-resistant heartwood.

Furthermore, the campus integrates numerous fruit-bearing and ornamental flora, such as three Mangifera indica (Mango) trees, three Psidium guajava (Guava) trees, and various ornamental palms like the Cyrtostachys renda. While these trees are often pruned for fruit production or aesthetics, which limits their maximum potential height, they still contribute steady, moderate sequestration rates ranging from 12.5 to 25 kilograms of carbon dioxide equivalent per tree per year. The presence of ecologically vital native Western Ghats species like Saraca asoca (Ashoka Tree), Terminalia arjuna, and Pongamia pinnata (Indian Beech) adds immense value not just in carbon terms, but in maintaining the native genetic heritage of the region.

By applying conservative, species-specific allometric scaling models to the one hundred and one recorded specimens, averaging an estimated 30 kilograms of carbon dioxide equivalent sequestered per tree across the diverse mix of heavy timber, fast-growing fruit, and smaller ornamental varieties, the total biological carbon sink of the campus can be established with a high degree of confidence.

The total annual biological sequestration equates to 101 trees multiplied by approximately 30 kilograms, yielding 3,030 kilograms of carbon dioxide equivalent, or 3.03 metric tonnes sequestered annually.

Beyond mere atmospheric carbon capture, these one hundred and one trees serve critical thermodynamic and hydrological functions. The dense canopy cover significantly reduces the localised urban heat island effect, shading concrete infrastructure and lowering the ambient air temperature across the campus. This natural phytoremediation directly reduces the electrical cooling load required by the heating, ventilation, and air conditioning systems inside the campus buildings, creating a cascading cycle of energy efficiency that further depresses the Scope 2 electrical footprint. Their

root systems also prevent soil erosion and facilitate the percolation of monsoon rains into the local aquifer, aiding in flood mitigation and groundwater recharge.

9.1.11 Net Carbon Footprint Synthesis

The ultimate metric of institutional sustainability is the net carbon footprint. This crucial figure is derived by aggregating the total operational greenhouse gas emissions, representing the sources, and subtracting the combined technological and biological offsets, representing the sinks. This synthesis provides a clear, quantitative snapshot of Marthoma College's progress toward absolute climate neutrality.

Carbon Accounting Category	Emission Source / Sink Matrix	Annual Volume (kg CO_2e)	Percentage of Gross Footprint
Gross Emissions (Sources)			
Scope 1: Diesel Generator	Stationary Thermal Combustion	1,271.16	3.5%
Scope 1: LPG Consumption	Stationary Thermal Combustion	211.79	0.6%
Scope 2: Grid Electricity	KSEB Power Draw	34,910.20	95.9%
Total Gross Operational Footprint		36,393.15	100.0%
Offsets and Sinks (Mitigation)			
Renewable Energy Infrastructure	Solar Photovoltaic Displacement	(25,652.05)	-
Biological Carbon Sink	Arboreal Biomass Sequestration	(3,030.00)	-
Total Sinks and Offsets		(28,682.05)	-
NET OPERATIONAL FOOTPRINT	Gross Emissions minus Total Sinks	7,711.10	~7.71 Metric Tonnes

Table 6: Net Operational Carbon Footprint Synthesis.

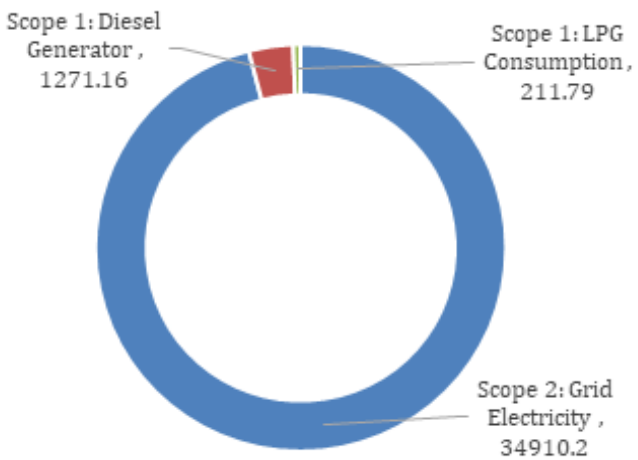


Fig.3. Gross Operational Carbon Footprint (kg CO_2e)

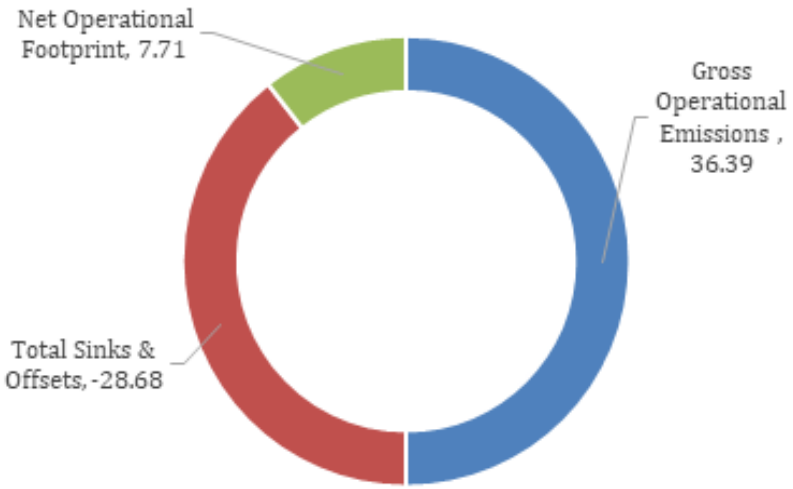


Fig.4. Net Footprint Synthesis (tCO_2e)

The synthesis unequivocally demonstrates that Marthoma College has already neutralized nearly 79 percent of its gross operational footprint. The 35-kilowatt solar photovoltaic array is the undisputed cornerstone of this environmental achievement, executing the vast majority of the heavy lifting in the campus's decarbonization effort. The biological sink provided by the mature arboreal assets offers a vital, continuous supplementary offset. With a net operational footprint of merely 7.71 metric tonnes, absolute carbon neutrality is not merely a theoretical or aspirational goal for the administration, but a highly feasible, near-term operational reality that can be achieved with minimal capital expenditure.

9.1.12 Per Capita Carbon Footprint

To contextualize the institution's environmental impact on an individual level, a per capita carbon footprint analysis was conducted based on the total campus population. Marthoma College supports a combined population of 520 individuals, comprising students, teaching faculty, and administrative staff.

When distributing the gross operational emissions (36,393.15 kilograms of CO_2e) across this population, the gross per capita footprint stands at approximately 69.99 kilograms of CO_2e per person annually. Factoring in the substantial solar and biological offsets, the net per capita footprint is drastically reduced to merely 14.83 kilograms of CO_2e per person annually. This exceptionally low individual footprint further underscores the effectiveness of the campus-wide sustainability and clean energy initiatives.

9.1.13 Strategic Decarbonization Roadmap and Recommendations

Marthoma College currently exhibits a highly advanced posture regarding environmental stewardship and energy management. To bridge the final 7.71-tonne gap, achieve verifiable Net-Zero status, and simultaneously elevate its ecological circularity and biodiversity metrics, the following strategic, data-driven interventions are highly recommended for implementation by the administration and the internal quality assurance cell:

Firstly, the immediate rehabilitation of the hostel biogas plant must be prioritised. The non-functioning 200-litre anaerobic digester represents a severe bottleneck in the campus's circular economy. Repairing and potentially expanding this unit to accept the massive 960.17 kilograms of bio-waste generated by the canteen will completely eliminate the fugitive landfill methane emissions currently escaping into the atmosphere. Furthermore, the generated biomethane can permanently displace the 71 kilograms of Liquefied Petroleum Gas currently utilised on campus, erasing the Scope 1 thermal footprint entirely. This represents a perfect closed-loop system where waste is converted directly into thermal utility.

Secondly, the college should explore a marginal

expansion of its solar infrastructure. The existing 35-kilowatt solar array leaves a small residual electrical footprint. Expanding the solar capacity by a mere eight to ten kilowatts would theoretically push the institution's Scope 2 emissions into negative territory. This would allow the college to act as a net exporter of clean energy to the regional grid, essentially subsidising the carbon emissions of the surrounding local community and creating a negative carbon footprint overall.

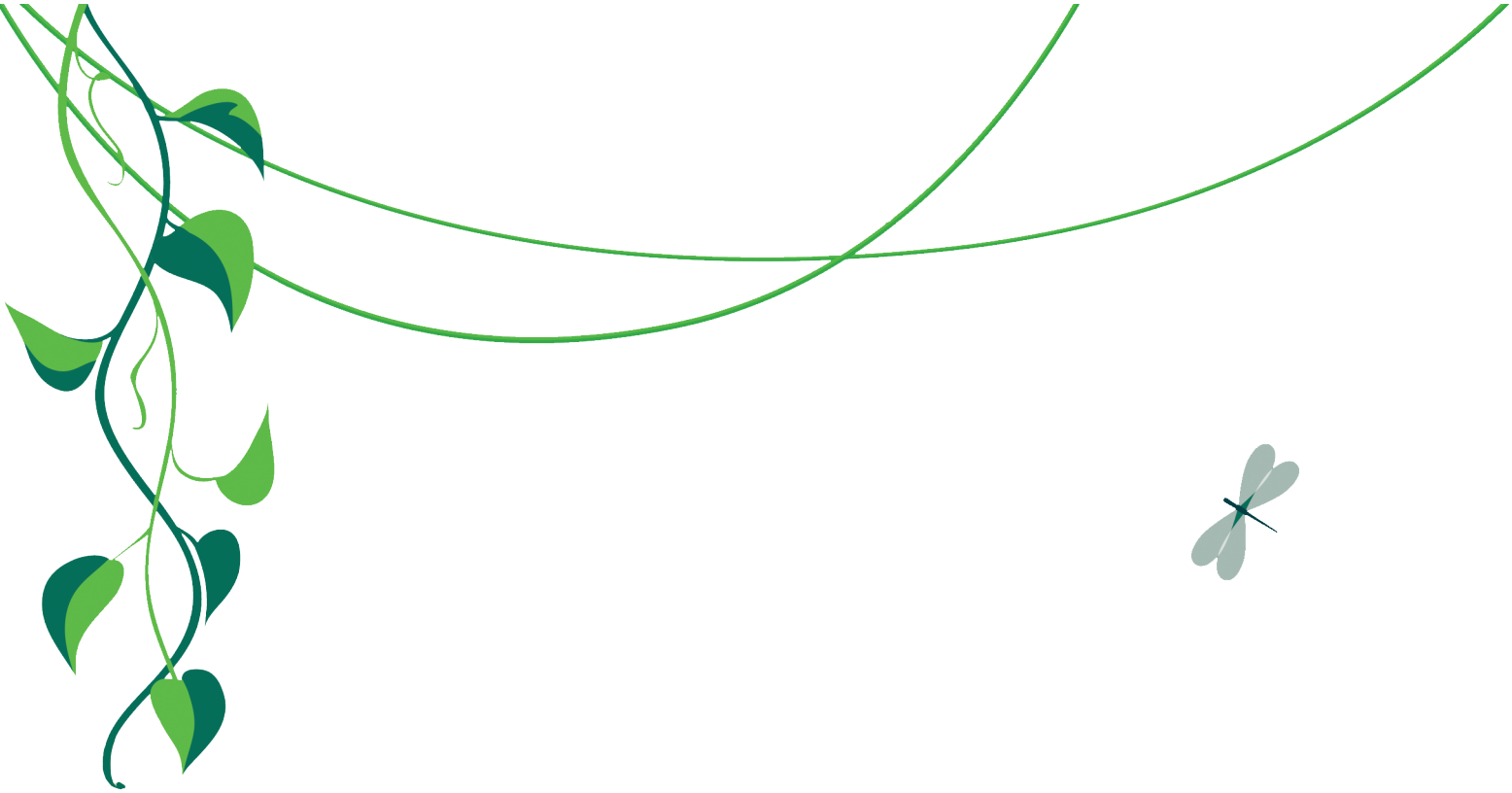
Thirdly, targeted plastic eradication protocols must be established in the campus canteen. With the canteen accounting for nearly 65 per cent of all campus plastic waste, generating nearly half a tonne annually, the administration should implement a strict mandate phasing out single-use plastics within all food service areas. Transitioning to biodegradable alternatives, natural leaf wrappers, or mandated reusable stainless-steel service-ware will aggressively shrink the institution's physical waste footprint and eliminate the downstream pollution vectors associated with plastic degradation.

Fourthly, strategic arboriculture and understory restoration should be integrated into future landscaping plans. While the existing 101 trees provide excellent canopy cover and carbon sequestration, the Simpson Diversity Index indicates impoverished reptilian, mammalian, and pollinator insect diversity.1 Future planting efforts should pivot away from ornamental exotics and focus exclusively on planting endemic, high-biomass, deep-rooted Western Ghats species. Cultivating dense, native shrubbery layers will restore broken ecological corridors, directly elevating the biodiversity indices for vital pollinator species like butterflies and bees, while simultaneously expanding the biological carbon sink.

Finally, the administration should formalise the avoided emissions framework regarding transportation. The staggering 127,412 liters of fuel saved via the shared mobility network is a monumental societal achievement. The college should formalise this spontaneous success into a recognised green commuter policy, potentially reserving prime parking for high-occupancy vehicles or incorporating electric vehicle charging infrastructure in the future. This ensures that as the regional commuter fleet naturally electrifies over the coming decade, the campus is structurally prepared to support zero-tailpipe-emission transit, cementing its status as a premier institutional model for holistic, data-driven sustainability.

9.1.14 Conclusion

Marthoma College demonstrates a highly optimised environmental performance, achieving a remarkably low net operational carbon footprint of approximately 7.71 metric tonnes of carbon dioxide equivalent annually. This success is primarily driven by their 35-kilowatt solar photovoltaic installation and the biological carbon sink provided by 101 mature campus trees, which together offset nearly 79 per cent of the institution's gross operational emissions. By repairing the non-functional hostel biogas plant to manage organic waste and marginally expanding their renewable energy capacity, the college is exceptionally well-positioned to eliminate its remaining footprint and achieve absolute net-zero status in the near future.



Climate change is
no longer some far-off problem;
it is happening here,
it is happening now

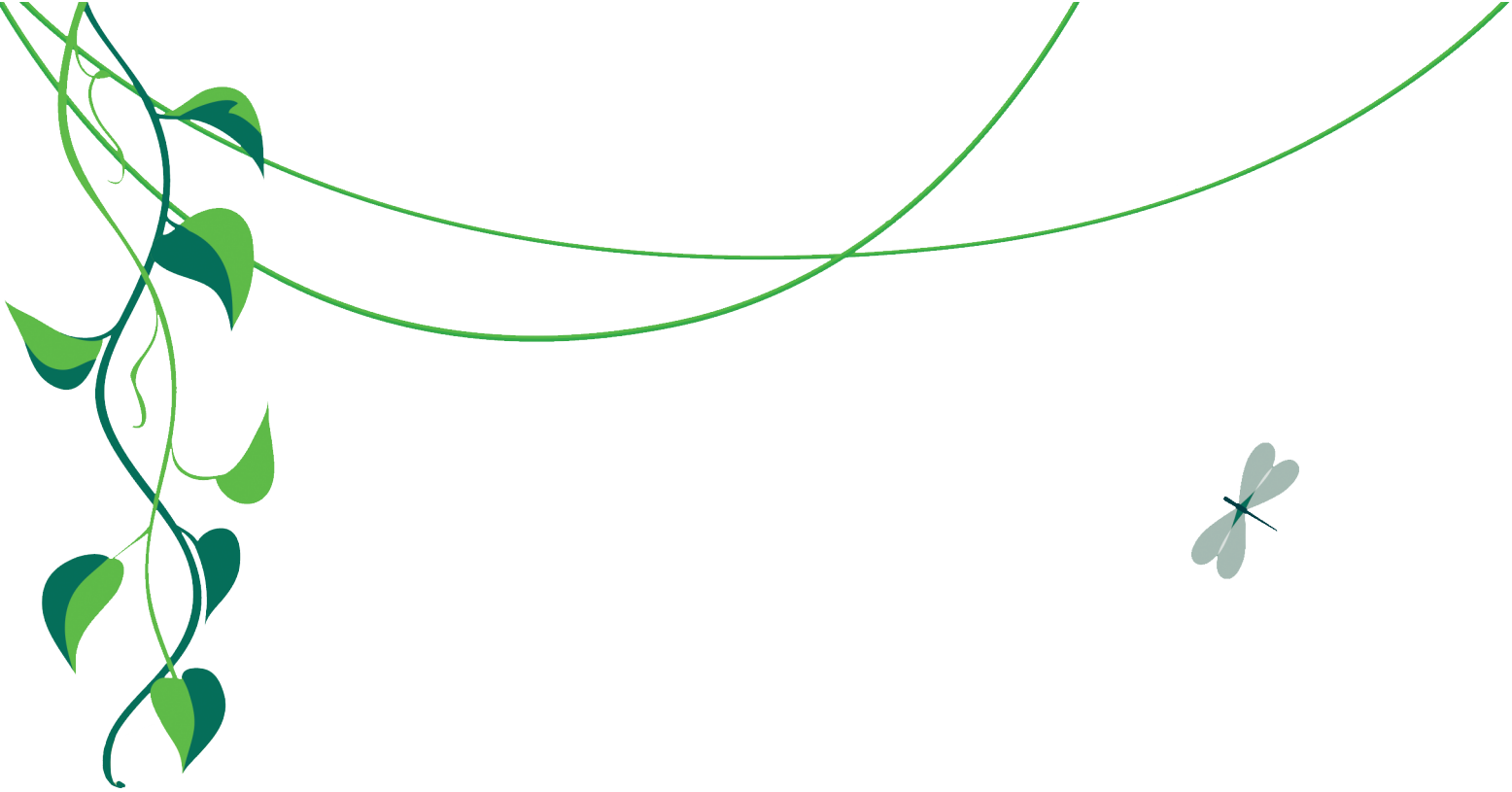
- Barack Obama

Chapter X

GENERAL CONCLUSION OF GREEN AUDIT & RECOMMENDATIONS

TIES

MAR THOMA COLLEGE FOR WOMEN PERUMBAVOOR
THE TRUTH SHALL MAKE YOU FREE



Never doubt that a small group of thoughtful,
committed citizens can change the world;
indeed, it is the only thing that ever has.

- Margret Mead

10

General Conclusions & Recommendations

10.1 GENERAL CONCLUSION

10.1.1 SDG 3 Good Health and Well-being

The Occupational Health and Safety Management System, aligned with ISO standards, establishes a comprehensive framework to ensure the safety and well-being of the college community. However, the institution must further strengthen its facilities in safety equipment for high-risk areas, emergency response measures, and communication channels. As part of this system, the institution maintains an accurate register of available services and provides facilities encompassing physical and mental health, medical support, social welfare, and legal measures, while documenting their delivery to effectively meet community needs. Furthermore, the availability of these services shall be clearly communicated to the college community and systematically implemented to address emergency risk management, health and environmental concerns, and infrastructure development. This approach shall embrace an inclusive community framework that incorporates psychosocial support, promotes overall psychosocial well-being, and fosters the progressive economic development of the communities served.

10.1.2 SDG 6 Clean Water and Sanitation

The college is equipped with a water storage system; however, its ageing infrastructure and inadequately designed plumbing network present significant challenges, as the existing layout makes it difficult to trace water distribution connections and determine the precise annual water consumption. The primary sources of water supply are a well and the Periyar River Valley Canal. Despite having access to sufficient water sources, the college has not experienced water scarcity, which is likely attributable to a lack of effective water conservation initiatives. It is therefore imperative to conduct a comprehensive mapping of the water distribution network and implement automated pumping systems, as current pumping data indicates overflow occurrences on multiple occasions. Water quality testing confirms that the water is safe for drinking, as it undergoes filtration before being distributed across the campus. Plans are currently underway to integrate water conservation into the academic curriculum, alongside community engagement through water quality assessments. This initiative aims to promote effective freshwater conservation methods, strengthen practical knowledge, and cultivate a greater awareness of the importance of freshwater resource management within the college community.

10.1..3 SDG 7 Affordable and Clean Energy

The Energy Management System (EMS) policy and plan establish a cohesive framework to achieve sustainability objectives while ensuring full compliance with ISO standards. The audit comprehensively evaluates the institution's energy management practices, identifying opportunities for improvement in collaboration with the

energy auditor and addressing critical issues related to electrical systems and safety protocols.

For enhancing energy efficiency, the college is actively partnering with the Bureau of Energy Standards and Electrical Safety. This initiative encompasses upgrading energy conservation infrastructure, integrating renewable energy concepts into the curriculum, promoting the adoption of star-rated appliances, and engaging with external agencies to leverage additional expertise and support experiential learning opportunities.

Concerted efforts are currently underway to optimise solar energy production capacity, to achieve measurable output at the earliest. In parallel, the college is expanding its cycling infrastructure by increasing the number of bicycles available to the campus community, thereby promoting sustainable commuting and reducing carbon emissions as part of its commitment to a carbon-neutral campus. Furthermore, the institution is actively exploring investment opportunities in alternative energy sources, with the overarching goal of attaining full carbon neutrality.

10.1..4 SDG 12 Responsible Consumption and Production

The college is committed to a comprehensive waste management system, implemented through the collaborative efforts of the entire college community in strict adherence to an established green protocol documented in the college diary. The primary focus encompasses waste reduction, recycling, and the systematic documentation of waste generation. Identified gaps, including inadequate waste collection points and storage facilities, are to be addressed promptly, with consistent documentation of waste quantities and annual sales records to external agencies to ensure the smooth functioning of the system.

Further value can be added to the college's sustainability efforts by effectively utilising the biogas plant for the optimal maintenance of the vegetable garden, a flagship initiative of the college known as 'Mannarivu' by integrating self-sufficient organic waste management practices and community-driven domestic initiatives. This approach aims to sensitise the college community to organic farming practices. Recently, the college has broadened its sustainability efforts by incorporating innovative strategies into the waste management framework, thereby enhancing academic development and fostering community engagement through participatory initiatives, a behaviour change approach, and the active support of the NSS

10.1..5 SDG 15 Life on Land

The campus exhibits a notably rich biodiversity, encompassing a diverse array of trees, herbs, and shrubs. Nevertheless, a significant gap remains in the representation of native plant species a deficiency that warrants prompt and considered attention. It is recommended that the institution strengthen its investment in campus biodiversity enhancement and the systematic integration of climate resilience practices.

Potential initiatives include the maintenance and strategic expansion of existing butterfly gardens, crop vegetation, and tree cover, all of which contribute meaningfully to carbon emission mitigation. In this regard, the campus has already achieved a commendable milestone: a net operational carbon footprint of approximately 7.71 metric tonnes of carbon dioxide equivalent (CO_2e) per annum. This outcome is primarily attributable to a 35-kilowatt solar photovoltaic installation and the biological carbon sequestration provided by 101 mature campus trees, which together offset nearly 79 per cent of the institution's gross operational emissions.

The establishment of dedicated native plant gardens would further strengthen local ecosystems, enhance biodiversity, optimise water consumption, and reduce long-term maintenance costs relative to conventional landscaping approaches. Complementing this, the creation of wildlife habitats, including birdhouses, pollinator gardens, and wetland areas, would actively promote species diversity and reinforce overall ecological health. The development of community gardens and sustainable agricultural programmes could simultaneously advance food security, reduce the institution's carbon footprint, and contribute to broader local biodiversity goals. In parallel, research initiatives focused on local ecosystem dynamics, endangered species identification, and climate change impact assessment would underscore the institution's commitment to environmental stewardship. Collaboration with local environmental organisations could further strengthen conservation efforts, encompassing species monitoring and habitat restoration. By prioritising these strategic measures, the institution will be well-positioned to significantly enhance its biodiversity profile and cultivate long-term ecological resilience in response to the escalating challenges posed by climate change.

10.2 GENERAL RECOMMENDATION

- Energy Management Plan (EnMS) Implementation: Implement the Energy Management Plan in structured phases, incorporating energy conservation measures and promoting the use of energy-efficient equipment such as LED lighting, five-star rated appliances, and BLDC fans. Strengthen alternative energy sources and carry out necessary infrastructure upgrades. Conduct annual identification and inspection of earth pits, alternative energy systems, and electrical room safety in compliance with the Bureau of Energy Standards. Perform annual risk assessments with findings formally documented in the EnMS. Ensure systematic internal and external audits are conducted regularly to monitor progress and compliance.

- Information, Education, and Communication (IEC) Programs Strengthen IEC initiatives by actively engaging all stakeholders, including students, parents, faculty, and the local community, to promote resource conservation awareness. Encourage students to propose and develop innovative, cost-effective energy-saving technologies through internships, paper publication, academic projects, or independent initiatives. Facilitate inter-institutional collaborations and techno-fests to foster knowledge exchange, teamwork, and innovation. With faculty guidance, students should be empowered to proactively present low-cost, sustainable energy conservation solutions.

- Water Management and Supply Mapping. Immediately commission a detailed mapping of the campus water supply and distribution network, clearly identifying pumping points, tank locations, and delivery destinations. Engage a technical expert or collaborate with a technical institution to develop this infrastructure map. Install automated water flow meters across all key areas, including the college and hostel blocks, to replace the current manual monitoring system and enable accurate annual water consumption tracking. Transition to automated motor pump controls to prevent water overflow and reduce unnecessary energy consumption. Initiate grey water treatment infrastructure as a long-term sustainability measure.

- Biodiversity Conservation and Campus Ecology Label all trees and shrubs on campus with QR codes linked to species information, and install informational boards featuring photographs and names of common biodiversity species at strategic locations. Encourage students, faculty, and staff to participate in biodiversity monitoring activities such as birdwatching events, insect surveys, and plant identification programs. Install nesting boxes and bird feeders across campus to support avian species, particularly during nesting seasons. Promote community engagement in biodiversity conservation through outreach programs, volunteer drives, and educational workshops.

- Waste Management System Enhancement: Continue and strengthen responsible waste management practices through a comprehensive, evolving plan that addresses emerging challenges. Maintain systematic records of waste volumes to ensure proper disposal and recycling. Increase waste collection points across campus and enforce source-level segregation through display boards, college diary instructions, and faculty-led orientation sessions. Ensure the efficient and regular operation of the biogas plant, given that food waste constitutes the dominant waste stream. Effective treatment of food waste through the biogas plant will yield quality manure suitable for campus vegetation and agricultural activities.

- Butterfly Garden Restoration and Native Flora Development. Through student initiatives, supported by NSS and NCC units, conduct a dedicated drive to renovate the campus butterfly garden. Assign students to collect and cultivate native plant varieties within the campus to attract pollinators, enrich biodiversity, and strengthen the native flora of the campus ecosystem.

- Canteen Hygiene, Safety, and Energy Standards: Enforce proper dress code and hygiene standards for all canteen staff and ensure that basic food safety and service standards are consistently maintained. Replace domestic LPG cylinders with approved commercial cylinders and schedule regular maintenance of all gas connections. Transition from hearth to wood stoves or, preferably, maximise the utilisation of the existing biogas plant for cooking purposes. Additionally, implement suitable treatment measures for canteen wastewater to ensure environmentally responsible disposal.

- The college is planning to further reduce its modest carbon footprint by promoting conservation practices and adopting eco-friendly and sustainable sources for future development.

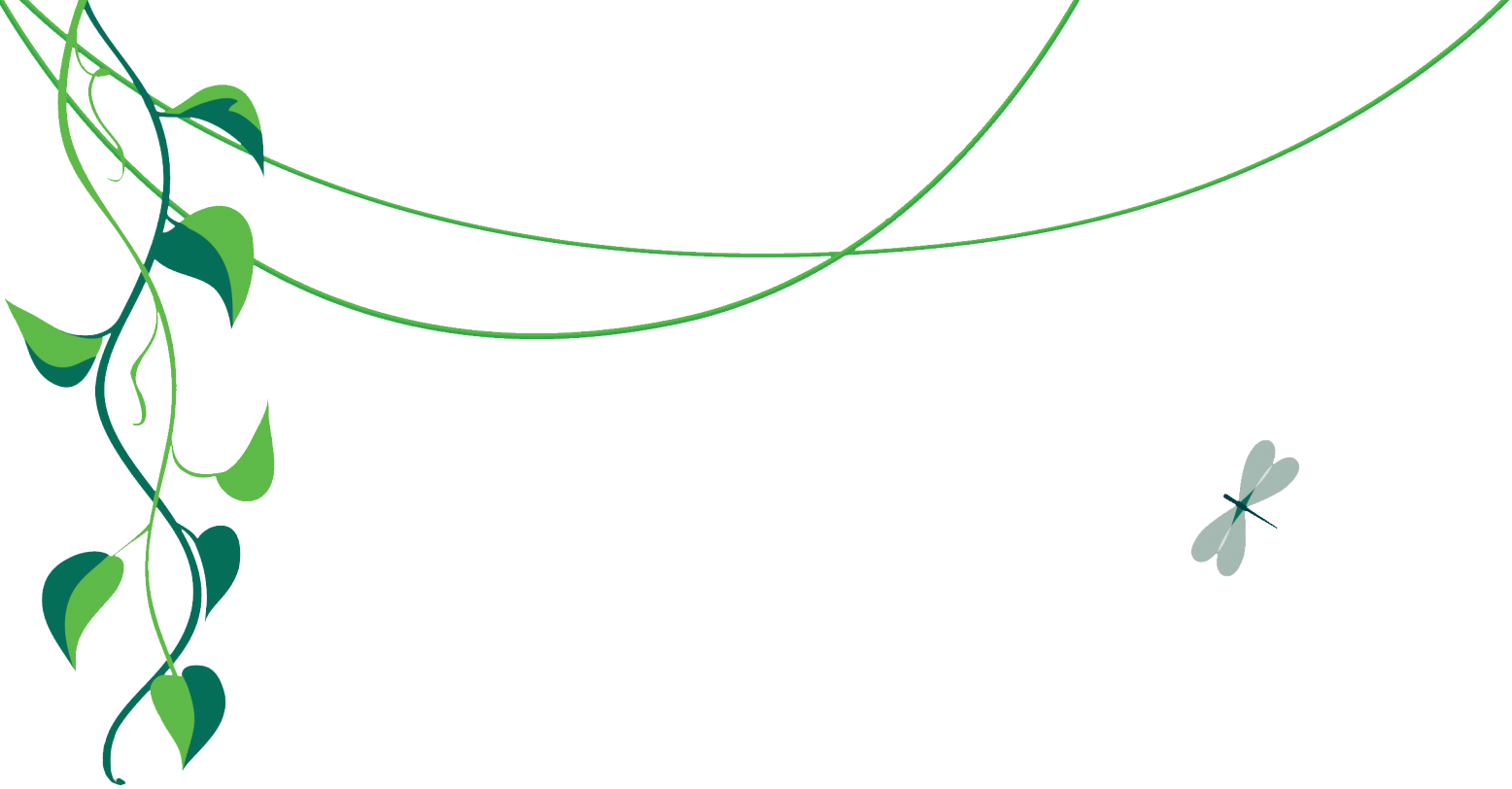
Chapter XI

BEST PRACTICES OF ENVIRONMENT MANAGEMENT SYSTEM (EMS)

TIES

MAR THOMA COLLEGE FOR WOMEN PERUMBAVOOR

THE TRUTH SHALL MAKE YOU FREE



Plans to protect air and water,
wilderness and wildlife
are infact plans to protect man

- Stewart Udall

11

Best practices of Environment Management System (EMS)

11.1 JANANI- Towards a Greener Horizon

Janani – A step Towards a Greener Horizon: The environmental conservation activities of the college have been operated in strict accordance with the Sustainable Development Goals and rapidly changing climatic conditions. The College has its own unique programmes in the name of Harithapadam, Vidyavanam, Chaithanya Saveri and Prashudhi.

Objectives:

- To generate awareness among the college community regarding the importance of leaving the beauty, bliss & bounty of nature to the future generations.
- To establish environmental footprints in all their operations.
- To equip the students to act as the ambassadors for ecological preservation and conservation

Today, the human race is currently undergoing the threat of a triple planetary crisis, which includes climate change, biodiversity loss & pollution. These intertwined challenges are harming the well-being & survival of millions of people around the world and jeopardising the Sustainable Development Goals. We need urgent & determined action from everyone & everywhere to preserve the ecosystem.

The Sustainable Development Goals adopted by the UN addressed this grave issue & aimed at improving the planet and the quality of human life around the world. Mahatma Gandhi University also carries on the momentum generated by the United Nations Organisation's Sustainable Development Goals with several ambitious projects, initiatives and programmes. In the area of curriculum with a view to generating environmental consciousness among the students, a compulsory course has been added to all courses within the University Departments and affiliated colleges. From 2017 onwards, degree courses of our college are strictly following the newly added curriculum and each department has a course on environmental history, ecology, environment and human rights. Apart from this, to enrich the curriculum, numerous action-oriented programmes were organised to equip the younger generations to be the vanguards of protecting our planet and ecology.

At this juncture, the Mar Thoma College for Women

moves forward to lead by example to establish environmental footprints in all its operations. The authorities of this institution internalised the concept of being with nature and felt that it allows the students to tune into the infinite wisdom of their highest self. This self-knowledge will move them into the uncharted dimensions of their personal power.

- Well-curved plants in rows along the boundary; most of which are perennial, have grown as mature trees, and many of which were planted way back in the 1990s. Over 200 trees of various species are spread around the 10-acre campus. The emphasis here is on floral diversity rather than monoculture. Our floral diversity bouquet has over 250 varieties of plants & trees.
- In collaboration with the Kerala Forest Department, Mar Thoma College has branched out a mini forest initiative named "VidhyaVanam ". It hosts a great variety of plant species & herbs from many lands, representing all world regions. Educative signposts are erected there with QR codes to help the users discover new plants in a fun & visual way.
- With an intention to promote local vegetation & farming, the college hostel premises are surrounded with organic & local vegetables such as tapioca, jackfruit, plantain, guava, etc. These organic fresh vegetables are being cooked & served to our college community. It is an assurance of the quality of the organic produce, as it is devoid of any additives or fertilisers.
- Our institution advances water stewardship and works to improve water security in our direct operations. The water recharging facility is made functional, and it acts as a reservoir for the rainwater collected from the campus catchment area.
- "If you have butterflies around, it means that biodiversity in the area is healthy & cheerful ". Keeping this in mind, our campus has initiated a butterfly garden in collaboration with the Social Forestry Wing, Govt. of Kerala, Forests and Wildlife. This garden helps students in understanding butterfly biology through observing various stages of a butterfly's development, their habits and habitat. Saplings of leafy as well as flower-bearing plants had been planted to welcome the guests.
- To encourage a positive, sustainable impact on our environment, the entire college community has introduced "ChaitanyaSaveri " to conserve energy and has switched over to LED lighting; apart from that, students are given proper training on making LED bulbs, solar lamps, etc. Moreover, the educational nameboards regarding the conservation of energy have been placed in the college campus.
- Mar Thoma College for Women takes immense pride in its initiatives to provide ample opportunities for students to understand the finer nuances of ecological diversity. With this regard, we have conducted an "Ecosystem Walk" to the nearby Iringole sacred grove so as to equip our students to enhance their learning and visualise the floral & faunal diversity of the preserved area in our vicinity.
- Encourage different cells & clubs to work with the local community, public and private sector organisations to improve the local environment & promote sustainable development.
- We introduced "Prashudhi " to ensure measures for minimising and managing the proper disposal of all forms of waste. For proper waste management, our institution introduced Vermicomposting on campus since it is easy to handle at a low cost.
- We follow the green protocol on a strict basis at all occasions.
- Encourage different cells and clubs to work with the local community, public and private sector organisations to improve the local environment and promote sustainable development.
- The college has a proper sewage system to divert the liquid waste to the waste pits.

Best Practice II: MarThoman Care

Marthoman Care, a continuing initiative of Mar Thoma College for Women, includes three important components & heads Snehasparsham, Snehasanthwanam and Snehasarvada.

The Social welfare activities of the institution, mainly centred on caring economically backward students through noon meal scheme (Snehasparsham), rebuilding and renovating the houses destroyed by the massive floods etc, extending financial support to the medical emergencies of students & staffs (Snehasanthwanam), initiative for giving free skill training to the students who were not financially sound and socially marginalized (Snehasarvada)

Objectives

- To inculcate social responsibility among students and staff thereby creating a better learning environment in the institution
- To empower and assist the women coming from socially marginalized sections to continue their education without any mental agony
- Empowering women with skill and practical training programmes
- To make the campus more inclusive and holistic in nature

Marthoman Care was a novel idea to extend holistic care to the students/staff who comes from economically backward sections. The scheme works in three realms:

Snehasparsham: Noon Meal Scheme: Faculties and staff of the college very often noticed that many of our students were not carrying their daily meals due to severe economic problems at home. The detailed discussions with these students and their friends pointed out the

urgent need for initiating a programme to eradicate hunger within the campus. Earlier, individual faculty members and staff helped many students get their noon meals. Snehasparham, an initiative envisaged to provide free meals to the needy students to improve their nutritional intake and promote regular attendance and vibrancy in the campus, was initiated in the year 2017 and has continued till this date. The resources for the above scheme have been shared by the management, teaching and non-teaching staff through regular financial contributions.

Snehasanthwanam: Fundraising for medical emergencies and rebuilding homes: One of the serious concerns of the college community was the severe economic crisis faced by our students, non-teaching and temporary labourers during the time of a medical emergency. The fundraising for medical aid (Snehasanthwanam) ensures that medical aid is accessible and inclusive to all students. This can include immediate assistance for accidents, sudden illnesses, or any other medical emergencies that may occur on campus or outside the campus. Apart from this, financial aid is provided to students and temporary staff to rebuild the dilapidated houses. These programs often rely on donations from faculty, management and non–teaching staff of our college. The institution visualises that having a safe and stable home is a crucial first step towards addressing all other challenges.

Snehasarvada: Free Skill Training: To equip the students coming from socially moderate regions to face the competitive society and life conditions, the institution has given free training in career advancement, soft skills, business management, financial literacy, marketing, and networking. By equipping women with valuable skills, they can enhance their employability, economic independence and skills necessary to start and manage their own businesses. Skill training programs often incorporate leadership and professional development components to help women students build essential skills for career advancement.

Noon-meal

Rebuilding home

Pedal in Action, Sustainability in focus Report of the Year 2024-25

MarThoma College for Women, has been steadily forging ahead, since its inception in 1982,with its mission of building up confident, selfless &responsible young women.Apart from inculcating lofty moral values, our institution adopts various health & wellness practices to achieve holistic growth. The institution upholds ecological sustainability & puts forth deliberate efforts in making the students conscious of being sensitive to environmental damage as well. The campus has initiated various measures to strengthen the physical dimensions of health & thereby equipping ourselves for ecological sustenance .

With this regard, Mar Thoma College for Women, has introduced health & wellness as one of the best practices. Inorder to nurture a healthy mind & body , the institution has promoted cycling on campus.The mission behind this incredible act is to promote a positive impact on student health & environment. The college promotes bicycle as a mode of transport on campus to encourage the sustainable development. Now the commuters in or very close to the campus prefer this non- motorized means as a mode of transport. A good number of

bicycles are available on campus to encourage more students to lead by example. The institution strongly believes that this noble endeavour can promote sustainable & inclusive mobility. It provides inherent, incredible & indefinite benefits by zero pollution.

Cycling offers a wide range of benefits for individuals & society at large, encompassing physical health, mental well- being, environmental sustainability & social connectivity.By the implementation of this sustainable mode of transport, the institution provides a network by connecting the campus to different destinations in a comfortable & safe manner.This cost effective means of transport can establish social bonding as well. Additionally, it has shown immense potential to promote gender empowerment.

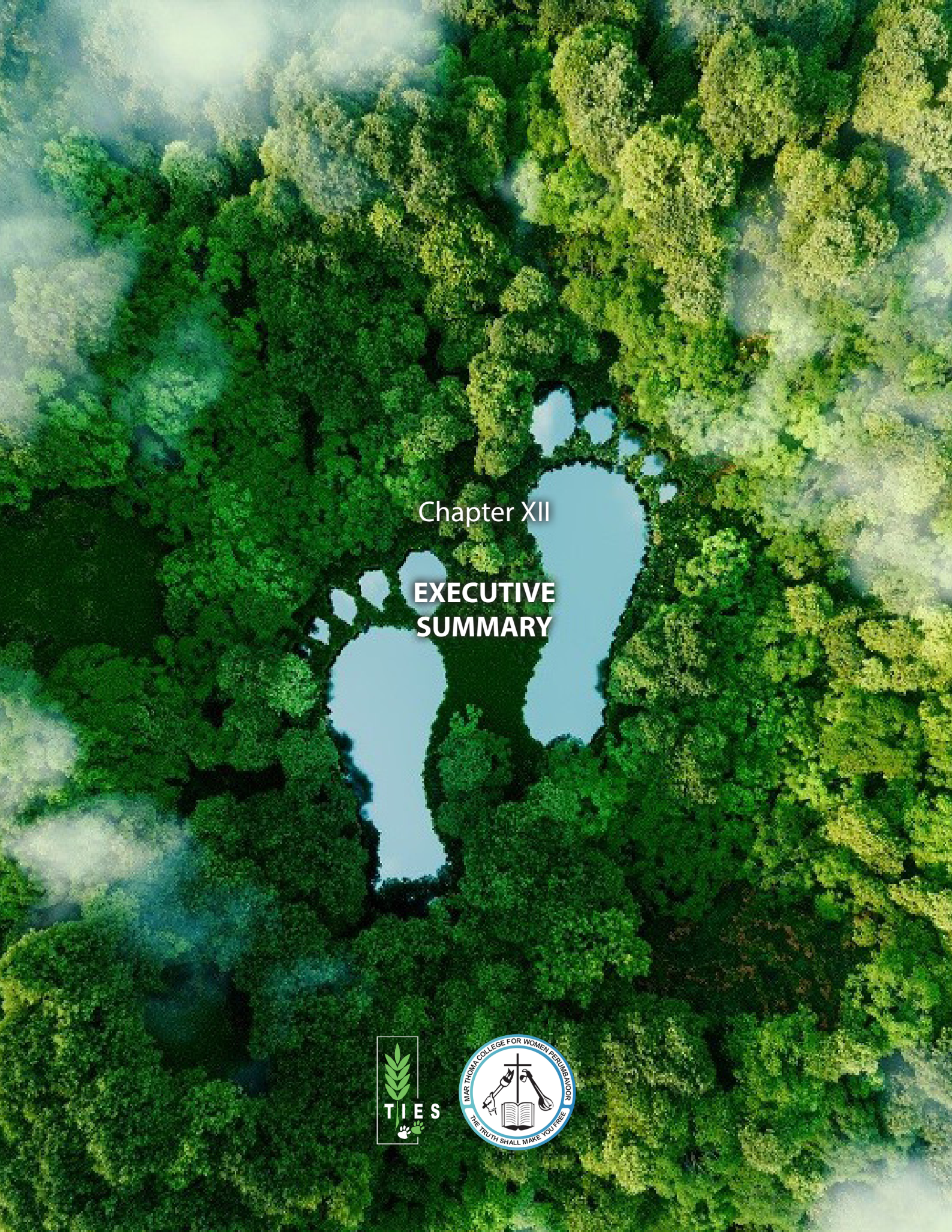
Inorder to promote the widespread use of bicycles, the institution has initiated awareness campaigns to highlight the benefits of cycling.

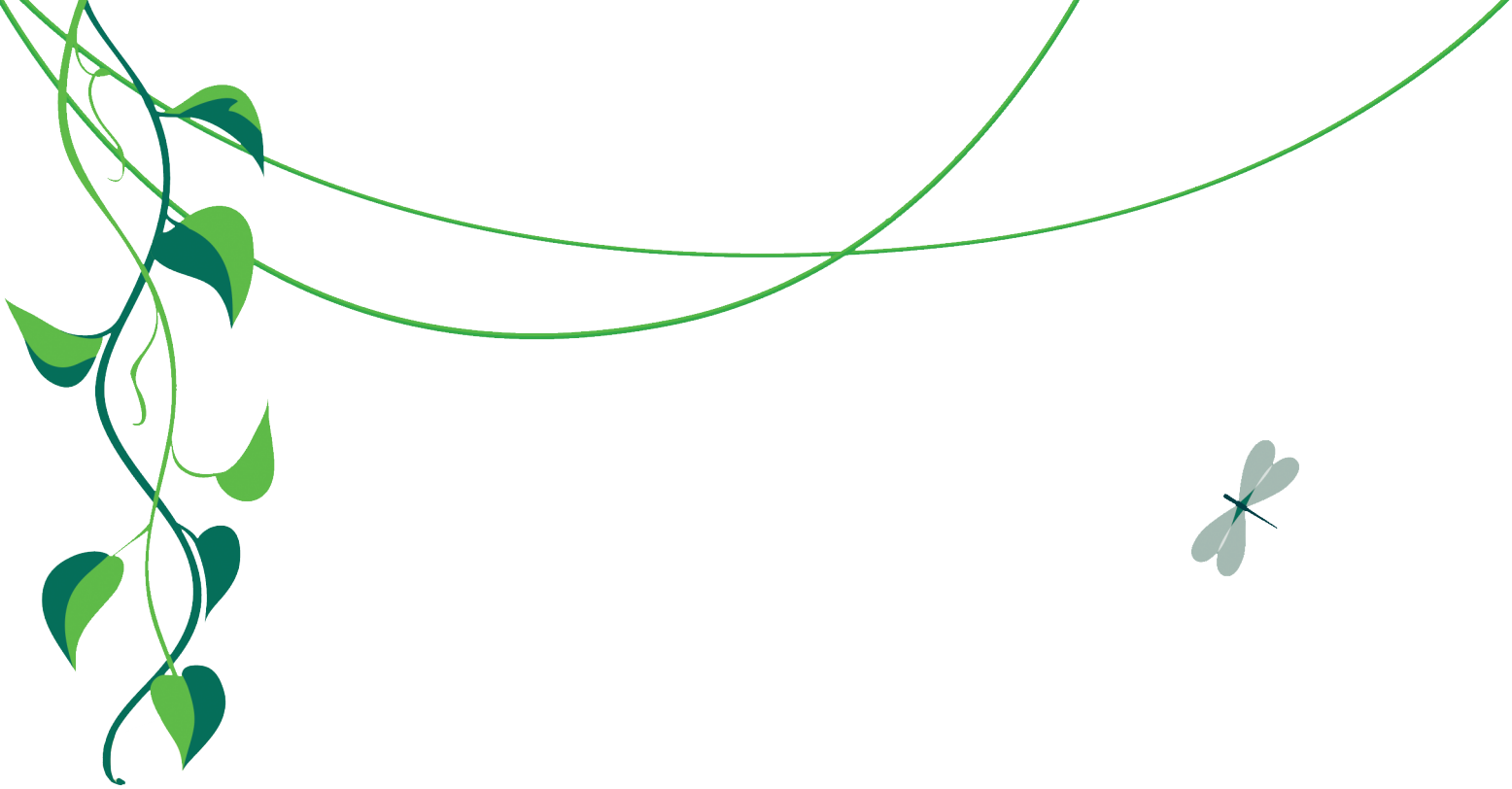
Organic farming: mannarivu

Nameoftheactivity	OrganicFarming
OrganizingAgency/Department	NatureandHeritageClub
Date	20-01-2025
No.ofStudentsParticipated	31
ResourcePerson/Coordinator	DrBibinKuriakose
Outcome	Toprovideawarenessaboutsustainability

Agriculture, the backbone of human civilization, place a vital role in promoting sustainability. As the Nature and Heritage Club, we recognize the significance of agriculture in providing basic *knowledge about sustainability. This reports the club activity in fostering sustainable practices and its impact on our environment by conducting organic farming in order to raise awareness on healthy living habits and against widespread reporting of cancer in our current scenario We cleared the land and made it suitable for farming with the help of advanced technical support as well as with the manual labour of club members. Next, we collected raw bamboo sticks from nearby places around the college. We also started collecting saplings, seeds and organic fertilizers such as abtec, dried cow dung, calcium carbonate and bone meal. On 6- 02-2025 we officially inaugurated our nature and heritage club, which was done by our chief guest Padmasree M K Kunjol sir and other guests by planting saplings
We prepared the soil and seeds for planting setting, the stage for the growth .As the further step we prepared the seedlings of brinjal ,chilli ,tomato ,spinach ,cucumber ,snake guard ,watermelon ,shamam ,pineapple ,scarlet guard ,peas ,pumkin and more .For accelerating the growth of plants we used crushed cowdung and other natural fertilizers
.With the help of periyar valley river project as well as water resource from college the irrigation have been doing through all these methods we have achieved quite a remarkable growth in a short.

Sl.No	Clubmembers
1	SarangiJayakumar
2	Anamika.L
3	ArathiK.U
4	FathimaBeeviA.A
5	Sreelakshmi.V
6	TreesaTitus
7	Nandhana.M
8	AneenaBalakrishnan
9	Dhanasree
10	NiyaSojan
11	Anjana
12	FathimaSidhique
13	Meenakshy
14	Angitha
15	MeenakshiB.Nair
16	EvanaAlias
17	Suriya
18	FathimaShahala
19	NaeemaParvin
20	AryaP.S
21	ShabanaP.M
22	AswathyDavid
23	Architha
24	Fathimath Noora
25	FathimaShababa
26	Femina
27	AnjanaSasi
28	FidhaFathima
29	JissaJinson
30	Gopika
31	KanmayaSriRaj


Chapter XII
EXECUTIVE SUMMARY
TIES
MAR THOMA COLLEGE FOR WOMEN PERUMBAVOOR
THE TRUTH SHALL MAKE YOU FREE

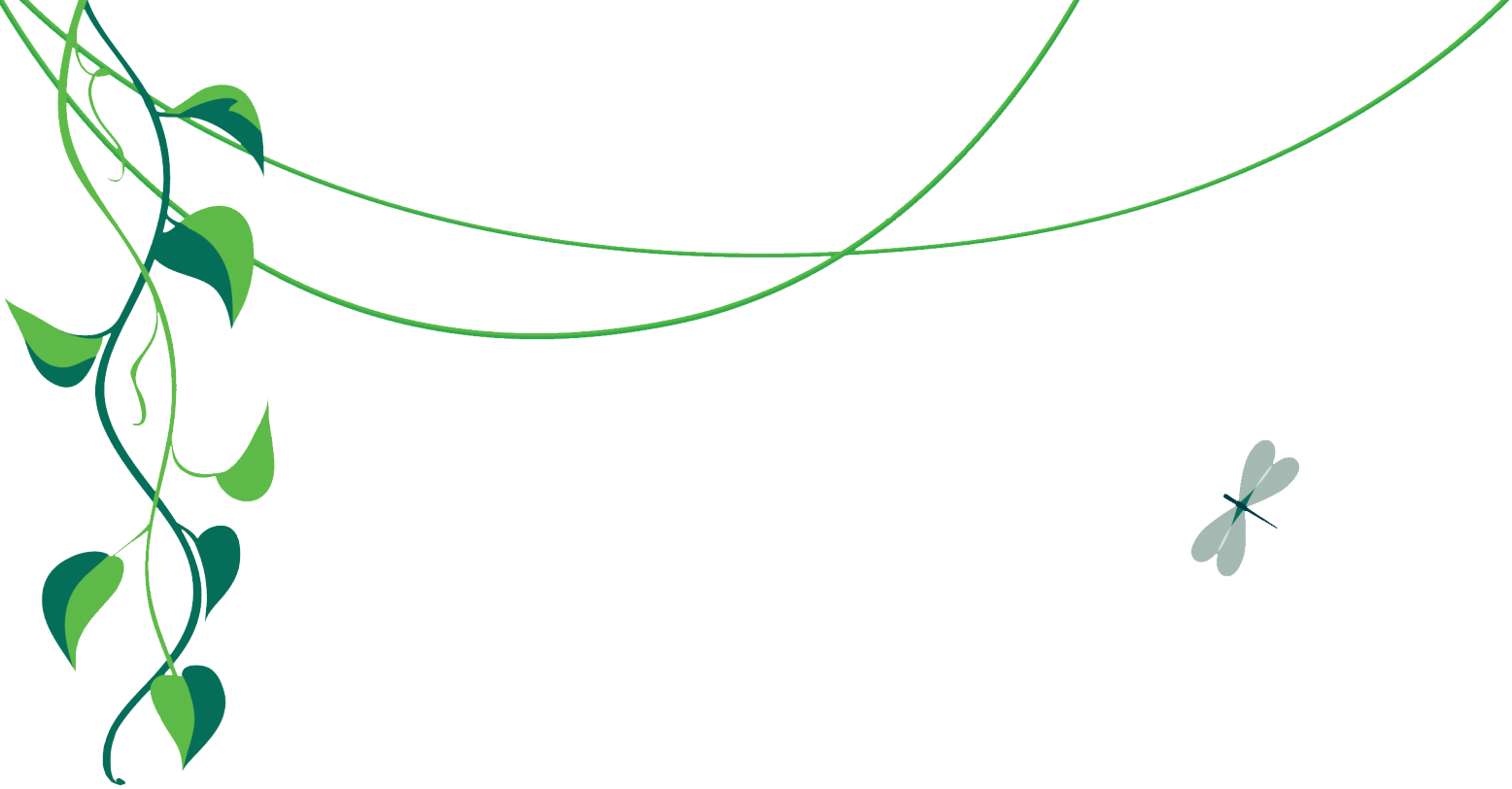


Small acts, when multiplied
by millions of people,
can transform the world

- Howard Zinn

EXECUTIVE SUMMARY

The college demonstrates a commendable and forward-looking commitment to sustainability, achieving a notably low net operational carbon footprint of approximately 7.71 metric tonnes of CO_2 equivalent per year, driven largely by a 35 kW solar photovoltaic system and 101 mature campus trees that together offset nearly 79% of gross emissions, placing the institution within striking distance of absolute net-zero status. Water management requires urgent attention, particularly through proper grey water treatment, regular maintenance and recording of water sources and fixtures, and structured hygiene training for mess and cleaning staff. Biodiversity assets in the form of mature trees contribute meaningfully beyond carbon sequestration, serving as natural sound buffers that improve campus liveability. Waste management has a clear near-term opportunity in repairing the non-functional hostel biogas plant, which would convert organic waste into an energy resource and close the remaining carbon gap. On health and safety, while the institution prioritises the physical, medical, and psychological well-being of its community, critical infrastructure gaps, including inadequate signage, insufficient parking, and the absence of disabled-friendly facilities, demand priority investment; most urgently, fire safety provisions must be extended beyond the auditorium into all academic buildings and subjected to regular monitoring. Taken together, the college possesses strong environmental and community foundations, and with targeted, cost-effective interventions across water governance, waste infrastructure, renewable energy, and safety compliance, it is well-positioned to achieve a fully safe, accessible, and net-zero campus in the near term.



I can't imagine anything more important
than air, water, soil, energy and
biodiversity. These are the
things that keep us alive

- David Suzuki

Mar Thoma College for Women, Perumbavoor
Perumbavoor, Ernakulam District,Kerala PIN : 683542
mtcwpbr@yahoo.in
Affiliated to Mahatma Gandhi University, Kottayam